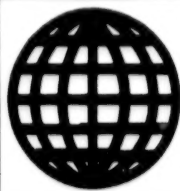


JPRS-EST-95-002  
11 January 1995



**FOREIGN  
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# ***JPRS Report***

# **Science & Technology**

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***Europe/International***

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# Science & Technology

## Europe/International

JPRS-EST-95-002

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**Germany: Office of Technology Assessment  
Evaluates New Materials**

95WS0093A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 25 Nov 94 p 8

[Article by "ghi" under the rubric "Companies/  
Research/Technology": "Materials Developers Have to  
Work Together With Users. Office of Technology  
Assessment Recommends Establishment of Integrative  
Innovation Processes"]

[FBIS Translated Text] Frankfurt—The technological competence and competitiveness of Germany as an industrial base will in the future depend on to what extent Germany succeeds in introducing innovations in materials into promising technological developments at the right point in time. This statement appears in the work report with which the Office of Technology Assessment (TAB) of the German Bundestag concluded its study on new materials.

The office recommends that the particular expert knowledge of all the participants in the value-added chain be taken into consideration. The opportunities and risks of innovations in materials and systems should be interlinked. Of course, further development should take place in a socially accepted environment.

Specialists are of the opinion that the adding of value by means of new materials is not substantially occurring until the end of the value-added chain, with the manufacturer of products and components. Developers and manufacturers of materials are not involved to a sufficient extent in the market success of new materials, they say. This has to be gotten over through intensive technology and knowledge transfer, which would also result in the inclusion into the catalogue of goals of materials development of desired system properties.

It reads further that, while basic research in the science of materials has a free and open structure, applied research on and development of materials are finding themselves exposed to increasing pressure for results. It

is up to the government to form a policy that encourages the free development of innovative forces, increases the likelihood that innovations will be applied, improves processes of diffusion into the economy, and results in self-sustaining applications in the economy.

The specialists at the Office of Technology Assessment argue that the way of directly supporting selected materials for key technologies that is continuing even with the Federal Ministry's for Research and Technology materials research program certainly has too short a reach. Open and indirect support would be more in line with system innovations.

This would mean that program emphases could change and that extradisciplinary fields of fundamental importance (environmental protection and industrial safety, for example) should also be able to be supported. Stronger incentives have to be created for small and medium-sized companies for committing themselves to the field of materials development. The integration should be directed by the partners of the association themselves.

The Office of Technology Assessment (Rheinweg 121, 53129 Bonn) is of the opinion that the support money should be given as research loans to association partners. They would have independent control over the money and would themselves decide on using the results profitably. If the results are not utilized by the companies themselves taking part, the government would take possession of the loan.

But all results of research and development should be passed on by the government within the framework of commercially organized technology transfer. The project sponsor would then get a new function. It would support the integration of extradisciplinary fields and would especially support smaller companies in technology transfer. The office is dispensing free of charge TAB reports No 26, "New Materials," No 22, "Roads to Integrated Research on Materials," and background paper No 3, "New Raw Materials for New Materials—an Inventory Taking."

**ESA Debates Small Satellite Program**

BR06011/4895 Noordwijk ESA BULLETIN in English  
Nov 94 pp 7-13

[Unattributed article: "Small Satellite Missions in the Context of the ESA Scientific Programme"]

[FBIS Transcribed Excerpt] [passage omitted on introduction] The much-changed environment of today—an asutere funding climate—is now encouraging a strong user interest in cheaper and more frequent missions, an interest that is forcing the established space agencies to rethink their approach to spacecraft procurement and mission design.

The ESA Science Programme has a strong interaction with the scientific community and is well aware of the latter's wishes. Consequently, the Agency has expended considerable effort in exploring several options for small scientific satellite missions, but so far without reaching any definite conclusions as to how to implement such missions in the context of the ESA scientific programme.

**Historical Background**

[passage omitted on background of ESA lack of small missions] In 1990, the Pinkau Committee, which had been conducting a policy review of the ESA Science Directorate, confirmed that small missions should be included in the ESA programme with the promise that 10 MAU [million accounting units] of savings would be freed for that purpose. One idea was that Member States could procure missions under the overall management of the Agency, but without the normal constraints such as an equitable return on an individual-mission basis.

Later that year, therefore, the Agency issued a "Call for Ideas" for small missions in an attempt to assess the potential interest. Some 52 proposals were received and evaluated by the ESA advisory groups. From this menu, two missions were selected for further study by way of being good typical examples of small missions in two different areas of science:

- SOLID, a mission to measure solar oblateness, irradiance periodicities and diameter variations, and
- CUBE, a mission to survey the cosmic ultraviolet background.

The aim of the study was to explore technical feasibility, to verify the scientific return, and to assess the potential cost.

The response to the Call for Ideas and the resulting study of the SOLID and CUBE examples showed that there were some genuine, scientifically justifiable, small-mission ideas seeking a launch opportunity and so in March 1992 a Workshop was organised to explore the possibilities further.

From the study, and also from the conclusions of the Workshop, however, it emerged that there were a

number of fundamental technical, managerial and policy subjects that had to be addressed before such a programme of missions could be considered for practical implementation. They included the need for a European small launcher, the constrained industrial procurement policy applied by the ESA Member States (the "geographical return"), and the need for a more flexible personnel policy within the Member States, ESA and industry.

All of this led ESA to the conclusion that the setting up of small-mission programmes was to be a lengthy process, precluding any short-term start to such a programme. [passage omitted on recognition of interest in program]

**Current Developments**

[passage omitted on question of what is small] The ESA Science Directorate is presently making a wide-ranging study of the issues involved—both scientific and organisational—with a view to developing a Directorate policy towards the procurement of small satellites for, or by, the European community. This study, which will eventually embrace a wide cross-section of the European scientific community is being carried out in three distinct phases. The first phase of activity has now been completed. During this phase, several meetings have taken place within ESA, each concentrating on a particular topic:

- Definition of "small satellites"
- The sounding-rocket experience
- Experiment selection
- Review of procurement approach
- Launcher options
- The legal framework
- Small-satellite operations

**Definition of "Small Satellites"**

This topic proved to be the most elusive, in that, despite all the studies made in the Executive and elsewhere, and the plethora of opinions expressed, there is still no universally accepted definition of what constitutes a "small satellite." Some authors use mass, others cost and short development times, while still others use relative complexity. The conclusion of the group is that the best criterion for defining a small mission is cost, from which all other parameters may be inferred.

As a reference for discussion, a total mission cost of about half a medium-mission budget, i.e., less than 160 MAU, has been assumed as the small-satellite threshold. Other, lower, financial thresholds could also be considered.

**The Sounding-Rocket Experience**

The sounding-rocket model is a good starting point for any discussion of small satellites in the context of the

ESA Scientific Programme as, over the period 1968-1972, some 183 launches were conducted with a 75-percent success rate.

Many of these early concepts could be applied today to a small-satellite programme, given the will to take the risks and to accept this level of success rate. It is worth noting that, although it was accepted initially that the sounding-rocket programme was a "high-risk" venture, failure was treated sufficiently seriously that additional costs were eventually incurred in an attempt to preclude future failures!

#### Experiment Selection

The selection of the PIs would be simplified. It could be the case, for example, that proposals that did not meet the technical constraints would not be accepted for scientific evaluation. The program team would be responsible for the initial screening (the sounding-rocket approach). Another constraint could be that only instruments that used established payload technology would be considered, to avoid development risks and consequent programme delays.

#### Review of Procurement Approach

The current approach to procurement will certainly need to be modified if small satellites are to be procured by ESA. To this end, some suggestions are to :

- reduce the requirement for an equitable industrial return
- leave science operations to PIs
- ensure a minimum of operations interaction with the spacecraft
- reduce the procurement time-cycle
- guarantee a long production run (at least five missions?)
- pre-procure a number of units/subsystems for a series of missions
- accept risk by means of a reduced model and testing philosophy, reduced redundancy, and the use of ML-standard components

The practicality of these suggestions needs careful assessment by all interested parties.

#### Launcher Options

This aspect is the most uncertain, as the only assured source of suitable small launchers so far is the United States, although there have been discussions on the possible use of Russian vehicles launched from European launch sites. In addition, a possible European small launcher is under study, but it is in a very early stage of definition. Ariane is not really a suitable vehicle in this context, as launch opportunities would be dictated by the availability of space with the "big users" (shared

launches); it could, however, be considered for "one-off" types of small missions, using the triple-launch configuration.

For the moment, therefore, the conclusion is that launchers such as LLV, Taurus and Pegasus would be the most viable.

#### The Legal Framework

Successful implementation of a technically- and cost-effective small scientific satellite programme would require, a priori, a critical examination of the procedures under which the hardware and services, including launches and ground services, are procured. Above all, a rapid decision-making process must be ensured so the development work is not hindered or complicated. Other elements that need to be considered are: the access to small launchers; ESA's role vis-a-vis that of the Member States and industry; and the timing and conditions of approvals.

A detailed examination of the various applicable texts—in particular the ESA Convention, the terms of reference of the Agency's Science Programme Committee (SPC) and Industrial Policy Committee (IPC), and the General Clauses and Conditions of Contract—will have to be made. If necessary, changes or waivers will have to be agreed.

#### Small-Satellite Operations

The operations process from inception to execution needs to be kept simple. Options range from full, but simplified, involvement of ESA's European Space Operations Centre (ESOC), to complete delegation of the task to PIs. The decision as to where the boundary point lies will be determined by the level of responsibility that ESA has for a particular mission.

#### Conclusion

While the ESA Science Programme Directorate has, as yet, no fixed policy on the practicality and potential for the introduction of a small-satellite programme, there is a recognised need to reduce the overall costs of missions, which would allow more flight opportunities and a small-spacecraft programme. Studies are therefore continuing, together with an exhaustive dialogue in the coming months with all potential participants—in the agencies, industry and institutes—to arrive at a definitive conclusion. If a small-satellite programme does emerge, all well and good, but even if it does not the European scientific community and ESA's delegate bodies will at least have a better idea of what can and what cannot be done within the boundaries of the ESA Science Programme. Any necessary changes will have been quantified and the basic data will be available for continued reference.



**ESA Plans New Astrophysics Program**

95WS0093C Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 24 Nov 94 p 8

[Article by Wolfgang Engelhardt: "ESA Planning New Major Research Program in Astrophysics With Rosetta. An Instrument Capsule to Be Set Down on Comet SW-3. Power Supply Via Solar Cells"]

[FBIS Translated Text] Frankfurt—After the success of their first Giotto space probe in the investigation of two comets, European scientists have decided to determinedly strengthen further their leading position in this area of astrophysical research. That is why the Science Program Committee of the European Space Agency (ESA) has decided on the Rosetta mission. The space probe is to fly to the comet Schwassmann-Wachmann-3 in the middle of the year 2003, in order to track it for a fairly long time in solar orbit after the rendezvous in the year 2010. Dropping an instrument capsule onto the comet is also planned. The European space organization states the cost of the Rosetta mission as around 1.2 billion German marks [DM].

ESA is inviting astrophysicists and comet researchers to submit by the middle of the coming year proposals for experiments on the Rosetta probe. The experiment designs selected by an independent committee will be announced in approximately one year, whereupon the researchers concerned will approach industry, which will construct most of the very complicated measuring equipment.

However, the Rosetta mission is developing quite differently than originally planned. This has consequences for the design of the space probe. Originally in this project a small amount of comet matter was to have been brought to the earth by means of a special re-entry capsule. But this plan on closer examination was found to be too complicated and too expensive. Instead, an instrument capsule that is to provide measuring data concerning chemical composition and physical state is to be set down onto the comet.

The design of the Rosetta probe is based on the Eurostar type of communications satellite platform from the French Matra Marconi Space company, a platform that has stood the test several times already in missions lasting for years in geostationary orbits. It is composed of a cubical center body whose edges are around two meters long, an antenna module, and the two large solar array booms.

The basic structure is of low net weight and can accommodate approximately 45 kilograms of scientific payload as well as sufficient fuel. Because the probe will be provided with three-axis attitude control, the research instruments have to have substantially better working conditions than the sensors of the Giotto probe did then. This is true above all for the images from the three CCD

[charge-coupled device] cameras planned for Rosetta, that are to cover the comet in several regions of the spectrum.

In addition, Rosetta will be the first space probe that will fly with solar cells as an energy source far out into outer planetary systems where the sunlight is very weak. Nuclear batteries, such as were used on various American missions, are not available in Europe.

Here the development of a new type of solar cell having substantially higher efficiency, that was first introduced recently by DASA-Telefunken, has come at just the right time for the Rosetta engineers. The two solar paddles together are designed to have a surface measuring 48 square meters and are to still produce 470 watts of electric power at a distance of 800 million kilometers from the sun.

On the way to the comet, Rosetta could besides in the year 2007 pass at a distance of 500 kilometers the asteroid Brita (1071), which will then be 375 million kilometers away from the sun. Depending on launching time, orbital course and conditions, Rosetta could study close up still more miniplanets, including the objects Rusheva-3516 and 1980-3716. The main maneuvers for approaching the comet will begin in June of the year 2008. Then it will be two more years, in July 2010, before the probe's cameras transmit to the ground station the first close-up images of the comet. The distance to the earth will then be around 630 million kilometers.

During the long transfer flight time the ESA antenna in Perth (Australia) will make contact with Rosetta just every two weeks in order to control the system and the transmission of data. Then the space probe will be radio-controlled round the clock three months at a time before it reaches the next destination.

Rosetta will approach the comet at a distance of 12 to 60 kilometers and map its surface with every sensor. At least 80 percent of the illuminated hemisphere is to be covered with one-kilometer resolution here. In a second research phase Rosetta will approach even to less than one comet diameter and search a 500 x 500-meter-large area on the comet onto which the instrument capsule is to land. Because the comet has only a weak force of attraction, the instrument package has to cling immediately when it lands.

Although the comet's orbital parameters are known only insufficiently thus far, the space experts have no doubt that they will find their destination as planned. The navigation procedure required was used in the Halley's mission already almost 10 years ago.

After the measuring instruments have been dropped onto the comet, Rosetta will remain in the comet's vicinity in order to act as a relay station for transmitting landing signals to the earth. Rosetta is to remain in the comet's vicinity also when it is approaching the sun, in



order to be able to scientifically analyze the comet's changes. Sublimation occurs then and the water ice melts on the comet's surface.

On 12 October of the year 2011 the comet will reach the point of its orbit closest to the sun. Its activity will surely be so violent then that the space probe will be destroyed approximately 8.5 years after it was launched.

#### **ESA Teams with NASDA for Experimental Intersatellite Link**

BR2212114494 Paris AFP SCIENCES in French  
8 Dec 94 p 6

[Unattributed article: "ESA-NASDA Agreement on Experimental Inter-Satellite Liaison"]

[FBIS Translated Text] An agreement was signed concerning an experimental inter-orbit link-up between the ESA's [European Space Agency] ARTEMIS and NASDA's [National Space Development Agency of Japan] OICETS satellites on 7 December in Paris by the heads of both agencies, Mr. Jean-Marie Luton and Mr. Masato Yamano.

ARTEMIS is due to be launched into geostationary orbit in 1997 as part of an ESA project aiming to set up a data relay service in orbit to enable satellites to communicate more rapidly with the ground, and with higher data flows due to recourse to optical frequencies.

As for OICETS, it should be placed in orbit at an altitude of 500 km the following year with a view to demonstrating pointing, collection, continuation techniques, and other optical frequency processes.

According to the terms of the agreement signed by the ESA director general and the NASDA president, which is the first major joint Euro-Japanese project in the field of telecommunications satellites, the experimental link-ups between the two spacecraft have to be carried out in optical frequencies and the S band.

ARTEMIS will ensure the bilateral data link relay between the ground and the Japanese satellite in low orbit by way of SILEX (Inter-Satellite Experimental Semiconductor Liaison), an optical telecommunications terminal on board the European satellite and similar equipment on the OICETS. The use of optical frequencies is a real technical breakthrough because they permit very reliable and very high capacity communications using small terminals.

In other respects, ARTEMIS, which is being manufactured under contract by Alenia Spazio (Italy) will have a useful load in the L-band ensuring mobile communications, notably between automobiles and trucks throughout Europe, including West Russia. Matra Marconi Space (France) is the prime contractor for SILEX.

#### **France: Plans for New Generation of SPOT 5 Satellites**

BR2012134494 Paris LA LETTRE DU GIFAS  
in English 24 Nov 94

[Unattributed article: "SPOT Image Orbiting of SPOT 5"]

[FBIS Transcribed Text] On October 4 1994, the French government decided to proceed with the creation of a new generation of SPOT 5 satellites. The success of the SPOT subsidiary developed by CNES, the French Space Agency, is at the root of the decision which aims at a possible orbiting as of 1999, which will guarantee continuous service to customers beyond the year 2010. SPOT Image is the world's leading enterprise offering geographic data obtained via satellite. The new generation of satellites is expected to expand the market with new applications while coping with a constantly growing demand for such traditional services as cartography, farming, ground planning, environment, geology and urban planning. The SPOT weighs in at 3600 kgs and will be lifted by the Ariane to the same circular, near polar orbit as earlier models, at an altitude of 830 km. It will have enhanced performance capability. Payload consists of three High Geometric Resolution (HRG) instruments instead of two HRV instruments. In addition to the HRG instruments, the SPOT 5 will be capable of carrying: Doris equipment for high quality orbitographics and precise localization of ground markets; and a "Vegetation" payload identical to the one carried by SPOT 4. As with other satellites of the SPOT line, the SPOT 5 will be developed in cooperation with Sweden and Belgium under prime contractorship of Matra Marconi Space.

#### **France: Ariane Failure Analyzed**

BR2112101394 Paris AIR & COSMOS/AVIATION  
INTERNATIONAL in French 9 Dec 94 pp 38-39

[Report by Christian Lardier: "Brakes Applied After Failure of Ariane (V70)"]

[FBIS Translated Text] Arianespace has failed to meet the planned challenge of launching 10 Ariane rockets in 1994. The failure of the 63rd flight on 24 January brought operations to a halt for four months at the beginning of the year, and the failure of the 70th flight on 1 December will result in a renewed delay of the launch program lasting several months. For the fifth time this—the seventh—failure is due to poor functioning of the rocket's third stage. Charles Bigot, the CEO of Arianespace, said: "Ten months after the failure of V63 we feel that this major blow is extremely serious. First of all we are sensitive to the reaction of our clients and understand their disappointment."

Yet the AR-42P rocket (with two strap-on, solid boosters) took off in the first launching stage lasting 27 minutes. Planned for 1938 local time, the launch only actually occurred at 1957 hours and 51 seconds because

of several timing stoppages. The first of these happened after a drop in pressure (of several millibars) in the liquid hydrogen tank (no doubt due to a measurement problem), and the second because of the satellite that had remained on main battery during the restart of the timing sequence at H-6 minutes. After nominal functioning of the first two stages, the new H10-3 third stage was ignited at H + 5 minutes and 41 seconds. At that moment, the two units injecting liquid hydrogen and oxygen from the gas generator were activated. It was then that a poor oxygen supply generated pressure of just 15 bars instead of 23 bars in the gas generator. The system functioned at a stable 70 percent of its nominal value. This halved the thrust of the HM-7B engine, and the order to shut it down came at 740 seconds instead of the planned 780 seconds. During the tenth minute of flight the stage was no longer really on its trajectory. It then started its descent into the thick layers of the atmosphere. At the moment when the injection on orbit was supposed to take place the rocket was at an altitude of approximately 100 kilometers [km] and travelling at a speed of 6.8 km/second. The stage and the satellite were destroyed when they re-entered the atmosphere between 1,000 and 1,500 km off the African coast. Only a few relatively heavy fragments probably fell into the Atlantic Ocean.

This type of failure had never occurred before. The previous breakdowns of the cryogenic HM-7B engine were blamed on the turbo pump (breakage of gears due to poor lubrication), the system feeding the engine (lack of tightness in the hydrogen valve and a delay in the firing of the ignition plug), and the hydrogen pump (heating of a bearing).

#### A Faulty Valve Or Defective Cooling?

This time it was something to do with the supply of the gas generator which had not been altered on the H10-3 stage. Because for the first time launcher used this new stage which theoretically enables performance to be enhanced from 60 kg to 140 kg, depending on the type of rocket. From the very outset, Ariane was modified to increase its maximum payload (1.8 tonnes [t] for the AR-1, 2.1 t for the AR-2, 2.6 t for the AR-3, 4.1 t for the AR-44LP, and 4.6 t for the AR 44L). The third stage was also modified in several ways by increasing the quantity of propellant and the duration of the powered flight phase. As a result, the H-8 stage was used on AR-1 (8 t of propellant consumed in 570 seconds), the H-10 stage on AR-2, AR-3, and AR-4 as from V10 (10 t in 720 seconds), the H-10-2 (or H-10 plus) as from V50 (11.1 t in 750 seconds), and the H-10-3 as from V70 seconds (11.8 t in 780 seconds). This new stage benefited from thrust propulsion, an increased mixture ratio, and a longer combustion duration, while at the same time retaining the required qualification margins. The HM-7B engine was slightly modified, and four qualification models were tested at the PF41 test installation in Vernon. Nonetheless, the feeding of the gas generator remained the same on all these stages, so the failure of

flight V70 cannot be blamed on the new stage. It could turn out to be a manufacturing fault in a valve or poor cooling of the HM-7B engine. However, it is not due to a design fault, like the failures of V2, V5, V15, and V18. These "youthful errors" could be explained by the fact that the Ariane program did not have sufficient funding when it started up (for example, the HM-7B engine had not been tested in a vacuum). Since then there have been three failures in 52 launches, or an average of one failure per 17 flights. According to Michel Mignot, the director of the Guianese Space Center (CSG), "the statistics predict one failure every 15 flights for Ariane 4 and one failure every 75 flights for Ariane 5."

For the fourth time, after the flights V54, V57, and V69, the procedure for increasing perigee velocity (PVA) was used to launch PanAmSat-3 (PAS-3). This involved placing the satellite on an orbit 200 to 300 km above the Earth in order to increase the mass of the satellite. The satellite then carried out two perigee maneuvers before settling into geostationary orbit. To do this it needs a liquid bi-propellant apogee boost motor which enables additional propellant to be carried. However, the satellite's increase in mass means that it can gain more than one year of operational life working from a fixed position. The PAS-3 satellite (of the type Hughes HS-601) weighed 2,985 kg at the launch, or 1,746 kg when in position. It had 16 band Ku repeaters and 16 other band C repeaters covering the United States, Europe, and Africa. It was supposed to broadcast 320 digitally compressed video channels or 54,000 telephone links.

The PanAmSat company (alias Alpha Lyracom), established in 1984, is the first private operator to compete with Intelsat. When it had launched its first satellite, the PAS-1 (alias Simon Bolivar) in 1988 it did not have any clients. Today, it has more than 275 clients spread throughout 75 countries. This success calls to mind that of the Luxembourg-based company SES [European Satellite Company], a competitor of Eutelsat with its Astra satellites. Not to mention the private company Orion Network Systems, which has just launched its first satellite Orion-1 into orbit over the Atlantic. The PAS-1 satellite, of the type GE/Astro-3000, is located at 45 degrees west (Atlantic). PAS-2, of the type HS601, was sent into orbit on 8 July 1994 at 191 degrees west (Pacific). PAS-3 was due to be placed at 43 degrees west to complement the Atlantic coverage of PAS-1. Hughes, the manufacturer, could deliver a replacement satellite in one year's time, and Arianespace is committed (as is normal) to giving it launch priority. The next satellite, PAS-4, which is planned for inclusion on the V77 flight in spring 1995, will be positioned at 68.5 degrees east, over the Indian Ocean. Consequently, the global coverage system will be brought into service at the end of 1995. The PAS-5, of the type FS-1300 manufactured by Lorsi, will be launched on Ariane-503 in October 1996. It will be fitted with 30 Ku band repeaters with the sole aim of ensuring direct television coverage over Latin

America. Then there will be a PAS-6 over the Atlantic in 1997, and in 1998 a PAS-7 over a new position of 58 degrees west.

Arianespace still enjoys the confidence of PanAmSat, and hopes to sign new contracts with Brazil and the Philippines soon.

#### **Inquiry Report On 19 December**

On 5 December it set up a committee of inquiry, comprising professionals in the industry who were given the mandate of submitting an initial report on 19 December. The members of the committee were Andre Barbot of SNECMA [National Company for the Study and Construction of Aircraft Engines] (chairman), Erick Slachmuylders of the ESA [European Space Agency] (vice chairman), Pierre Marx of the CNES [National Center for Space Studies], Michel Buchwalter of the DASA [German Space Agency], Marco Motta of Fiat Avio, and Pierre Delobel of Techspace Aero. The date on which flights will start up again will not be made known until the problem has been resolved. According to Charles Bigot, "assuming that the manufactured launchers are cleared of having caused the failure, we will be able to resume launching immediately. However, it is difficult to accept such a hypothesis. No doubt there will be other hypotheses, recommendations, and work to be done over a certain period (weeks or months). I dare not envision the possibility of long qualifications." He also said: "We have confidence in our objective (30 launches in three years), which will be maintained via a rhythm of one launch every three weeks."

"Thanks to this rhythm we will make up for time lost during this period by the end of 1996."

Despite this latest failure, the Ariane rocket remains the most reliable launcher in its category. Only the U.S. Delta rocket, which launches a payload of just 1.8 t into geostationary transfer, is more reliable. The true competitors—Atlas-Centaur, Proton, and LM-3A—have also suffered problems, notably two failures of Centaur's cryogenic stage in 1991-92, and two failures of the LM-3A's cryogenic stage over the same period. And some would say that with Ariane-5 this accident would not have happened because the cryogenic motor is tested for 8 seconds at lift-off. In other words, the problem would have been detected immediately and the engine shut down.

#### **France-Germany: Space Skin Electrode Envisioned for Clinical Practice**

95W50080C Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 24 Nov 94 p 8

[Article by eka: "Electrodes with Radio Transmitter on the Skin. The Space Product Can Also Be Used in Clinical Practice"]

[FBIS Translated Text]

The European Space Research and Technology Center (ESTEC) had the French companies Carrar and Matra Marconi Space develop a compact but extremely light body electrode. This electrode is capable of transmitting medical data in a wireless manner. This element, called the Telectrode, measures the physiological data to be studied using integrated sensors. Following amplification and formatting, it transmits these data to a base unit that can be up to five meters away. The computer of this base unit stores and evaluates the data. Such electrodes have already proven themselves practical in space travel.

The wireless Telectrode is to provide its wearer with more freedom of movement. It allows the test persons to move freely within the transmitter range and to pursue any activity, for example, exercises for stress tests. Because there is no electrical contact between the skin of the body and the sensors, the Telectrodes are intrinsically safe, it is further claimed. They allow real-time data acquisition and immediate detection of electrode defects.

Initially, a prototype to record electromyograms was produced. This can be used to study electrical muscle activity. This Telectrode consists of three electrodes connected to one another electrically. Two differential electrodes are attached to the ends of the muscle to be measured and contain a sensor and a small signal amplifier. The third electrode serves as a reference. In addition, it is equipped with two tiny lithium batteries, a microcontroller, 8-bit A/D converter, ultra-high frequency telemetry transmitter and a three-meter long antenna.

The signal is transmitted to the fixed station at 19.2 kilobits per second. The complete Telectrode, including the battery (15 hours of continuous operation), weighs only about 20 grams.

The use of Telectrodes is not restricted to recording myograms. Equipped with sensors adapted to the particular task, they can also measure any other physiological data thereby providing doctors with important information for diagnosis and therapy. Under consideration are long-term recording of electroencephalograms of the brain, electrocardiograms and cardioechograms of the heart and electrooculograms of the eye.

Even simple values such as the body temperature, respiration rate, heartbeat or, with the aid of angular encoding and acceleration sensors, the position and kinetics of different parts of the body, can be determined and observed on a continuous basis.

#### **Germany: DLR Calls for More Innovation in Space Research**

95W50103C Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 2 Dec 94 p 8

[Article by p.e.t.: "DLR Wants to Direct Research More to Meet Needs of the Economy. Herziger: 'Innovation



### Can Be Planned.' DLR Wants To Open Up To Cooperating Partners from All Branches of Industry"]

[FBIS Translated Text] In the future, results of space flight research are to lead more quickly to the development of marketable products at the DLR. The German Aerospace Research Institute [DLR] in Cologne-Porz is here following a "spin on" strategy: to this end, scientific and technological potential in the DLR is going to be expressly oriented to meeting the needs and uses of business and industry, to the applicability of existing industrial technologies and to their continued development, reports DLR CEO Professor Dr. Walter Kroell.

In contrast to the well-known "spin off" effect, application is not to be marketed as more of an accidental by-product but instead should already exist as a significant developmental goal at the beginning of the process. Innovation can be planned, according to Professor Dr. Gerd Herziger, who is responsible for scientific and technological transfer at the DLR. But it has to be organized early on together with the users [of the results of such innovation].

Companies from various branches of industry are allegedly very interested in the scientific and technological potential of the DLR—in areas such as automation and robotics, new materials, intelligent structures, measurement and testing technology, laser technology, energy and environmental technology, traffic engineering, telematics and telemedical applications. With its new orientation, the DLR intends in the future to make a "exemplary contribution to strengthening the international competitiveness of German industry."

The concept of transferring knowledge is first of all directed toward companies in the aeronautics and space industry and energy technology, but it would be available to all sizes of companies from all branches of industry. Yet it is cooperation with innovation-intensive, middle-sized companies which is of particular interest to the DLR. Technology oriented company start-ups and spin-offs by DLR workers to form new companies would be highly valued in the company's future strategy.

The DLR offers as a model three examples of transfer from institutes of the organization. The first deals with the remote control robot experiment Rotex, with which the DLR began development of a multi-sensory, lightweight generation of robots capable of learning. It has led to an artificial muscle, to small powerful actuators and also to medical applications in minimally-invasive surgery. Additionally, the DLR did pioneering work in 3D graphics.

Second, the DLR points to ceramic composites which are allegedly better suited than any other materials for use in future space transport systems—because of their stability at high temperatures, among other reasons. A third area concerns plasma jet technology for surface treatment at extreme temperatures, which can be utilized in [areas ranging from] prosthetics to electrolysis.

Among other things, the electrode coatings developed by the DLR for hydrogen-producing alkaline water electrolysis are currently the best in the world with regard to energy use and stability. But the plasma spraying technique also promises considerable economic advantages in construction of high-temperature fuel cells.

### German-Russian Cooperation in Satellite Launches Summarized

#### DARA Opts for 'Piggyback' Launches

95WS0119A Berlin *INGENIEUR DIGEST* in German  
Dec 94 pp 16-17

[Article by Olaf Goering: "Trend Towards Piggyback"; Subheadline: "Besides Communications Satellites Weighing Tons, Increasingly Mini- and Micro-Flight Vehicles Are Being Launched into Orbit: Savings Tack or Technology Trend?"]

[FBIS Translated Text] The first mission of a German reentry capsule using a Russian booster is clinched: the contract for the micro-returnable MIRKA capsule between Kayser-Threde GmbH, the Central Specialized Design Bureau (ZSKB) and the DARA (German Space Agency) space agency stands. In the spring of 1996, piggybacking on a Russian Foton capsule, it will be launched from Plesetsk aboard a Soyuz rocket. After a flight of 14-16 days at an altitude between 400 and 200 km they will both land in Kazakhstan.

The idea of flying micro-returnable capsules or other reentry vehicles "piggyback" on Russian reentry space vehicles was created at Kayser-Threde. Since 1991, DARA has supported a joint project between Kayser-Threde and Jena Optronics for the development, manufacture and testing of MIRKA. This 100-cm diameter spherical capsule with a total weight of 150 kg is supposed to prove that reentry experiments can be done inexpensively. Since the Foton infrastructure can be used up to separation when leaving orbit, MIRKA can be designed much simpler.

Such "piggybacks" are also virtually part of the standard for Ariane launches. For example, in the summer, an Ariane 44LP, enhanced with two each additional solid and liquid fuel rockets, carried into orbit not only the Intelsat 702 weighing 3.7 t [tons] built by Space System/LORAL [expansion not given] in California, but also two British defense ministry microsatellites, STRV 1A and 1B.

The number of such microsatellites that have ever been launched is a mystery even for space experts. The only obvious fact is that lately there has been increasingly more discussion of such satellites whose weight and dimensions recall the pioneering days of space flight in the late fifties and early sixties.

At that time it was primarily the limited payload capacities that set the limits. The ever more demanding objectives of achieving geostationary orbits above the

earth's equator, exploration of outer planets and manned space flight, led to the development of ever more powerful booster systems. Simultaneously, the satellites were growing ever larger and more sophisticated. The requirement for transmission capabilities for broadcast satellites, the complicated and highly sophisticated problems of remote sensing systems and other tasking problems even today still call for systems weighing tons that not infrequently cost well over a billion dollars.

Such expensive equipment, naturally, has to have a lifetime of at least eight to 10 years and be correspondingly reliable. And that is the fly in the ointment. Again multiple problems are setting limits on further increasing complexity.

First, costs. Only a handful of nations or even private institutions are any longer capable of bearing the costs on their own. International cooperation in space is, in fact, increasingly the practice. Experience shows, however, that preparation, financing and implementation becomes even more drawn out and therefore more costly with increasing complexity. A concrete example of this is the U.S. Freedom space station that is now to be realized jointly with the Commonwealth of Independent States, Japan, Canada and Europe.

The second problem is launch failures or loss of the system in space. In an instant, millions of dollars go down the drain. Orbital recovery or repair, as impressively demonstrated by the astronauts, is only exceptions.

Third, the long period of use hampers the rapid testing and introduction of new technologies and systems since even for the deployment of a new space vehicle it is necessary to wait several years. At best, there may be a routine exchange of equipment in manned space stations. Russian cosmonauts have been practicing that now for years in the MIR space station.

The rapid development of microelectronics and of various sensor technologies currently facilitates the solution too of very demanding tasking using significantly smaller compact systems. Universities and research institutes, above all, have recognized this in recent years and are pushing the deployment of mini-satellites less than 500 kg or of microsatellites weighing 20 kg and measuring less than 50 cm lengthwise or in diameter.

Examples of this are the TUBSAT developed and built by the technical university of Berlin, the BREM-SAT from Bremen's university, or the TEMISAT built by the Munich firm Kayser-Threde for Italy's Telespazio. It was Kayser-Threde, in fact, that signed a contract with the Geo-Research Center [GFZ] in Potsdam for a small passive laser reflector satellite for precision geodetic measurements. GFZ 1, a 20-cm diameter globe weighing 20 kg covered with laser reflectors, is to be released from the MIR space station via the mini-satellites lock.

Since the mid-eighties, U.S. firms have also recognized the trend and are offering basic systems for speedy

realization of solutions. An example is Lockheed's SMALLSAT satellite bus for payloads up to 450 kilograms. In the U.S., the trend to smaller satellites is also bolstered by the partial release of SDI [Strategic Defense Initiative] program research results that enable building tiny sensors that are extremely powerful.

Certainly, the most convincing argument is that in the case of unused payload capacity, microsatellites are transported along significantly cheaper—often even at no charge—by large booster rockets. Even NASA, that is used to large projects, has been convinced that research of critical space problems can be also significantly accelerated as a result and more flexibly designed. It has designed a program aimed at developing compact satellites for research that cost no more than \$35 million and are already ready for launch three years after the inception of the project.

### CHAMP Project

95WS0119B Berlin INGENIEUR DIGEST in German  
Dec 94 p 16

[Article by Olaf Goering: "East Germany's CHAMP"]

[FBIS Translated Text] The German Space Agency (DARA) is also supporting targeted development of mini-satellites. A mini-satellite study is currently being undertaken at the Geo-Research Center (GFZ) in Potsdam specifically to support the firm's activities in the space sector and institutes in the new laender.

Under the project designation of CHAMP [Catastrophe and Hazard Monitoring and Prediction], the possibilities are to be studied for a mini-satellite with a payload of approximately 100 kg for testing technologies for monitoring earthquakes and volcanoes as well as probing the lower and middle atmospheres with the exclusive participation of East German institutions.

Taking part, therefore, in addition to DARA and the GFZ would be institutes of the German Aerospace Research Institute (DLR) and 10 firms in the new laender.

The satellite is being designed for a low polar orbit at approximately 400-600 km altitude. Costs for realization are supposed to total nearly 50 million German marks. The year 1997 is being eyed for the inception of the mission. The satellite's lifetime is to total two years.

For on-board instrumentation recourse will mostly be had to systems with which experience has already been acquired on earlier missions. Therefore, laser reflectors and the PRARE [Precise Range and Rate Equipment] microwave system will be used to determine tectonic and seismic deformations of the earth and for accurate determination of the earth's gravity field. Magnetometers and Langmuir probes will measure anomalies in the earth's magnetic field and other instruments will detect trace gasses such as ozone. An on-board data collection



system will be used for real-time data transmission from measuring points distributed on the earth to evaluation centers such as the GFZ.

#### **Netherlands: Remote Sensing Program Results Assessed**

*BR0901141895 Amsterdam TECHNISCHE WEEKBLAD in Dutch 14 Dec 94 p 6*

[Report by Feico Houweling: "Netherlands Remote Sensing Equipment a Success"]

[FBIS Translated Text] Rijswijk—Netherlands researchers have carved out a leading position in the manufacture of remote sensing instruments. In fields such as the detection of oil slicks at sea and wave and wind predictions, applications are ready for use.

This became evident during the symposium held last week in Rijswijk, where the results of the first European Remote Sensing Satellite (ERS-1) were discussed. This satellite was launched in 1991 and has since been providing data about wind, waves, ocean currents, and ice caps. For these purposes, the satellite is fitted with various radar systems and infrared sensors.

As a result of earlier problems with the Ariane launcher, the launch of ERS-2 has been postponed by at least six months to the fall of 1995.

The Department of Public Works has successfully carried out tests on the use of radar observations by ERS-1 to supplement the inspection flights which the department's remote sensing aircraft has made over the North Sea. The inspections are intended to detect oil spills and, if possible, to catch the perpetrators.

B.P. Van IJsselstein of Fokker Space & Systems pointed to the Sciamachy, an instrument developed by his company in collaboration with TPD [Technical Physics Service] and SRON [Netherlands Space Research Foundation]. This is an extremely accurate spectrometer for detecting low gas concentrations in the atmosphere, particularly ozone. This instrument will form part of the European Environmental Satellite (ENVISAT) to be launched in mid-1999. According to Van IJsselstein, the Sciamachy project is proof that the Netherlands has developed into an internationally recognized supplier of

measuring equipment. He also cited the manufacture of satellite solar panels by Fokker as an example of a successful industrial development in the field of space travel.

The Delft Hydrodynamics Laboratory has drawn up a list of remote sensing products which are likely to succeed on the market. This list includes wave predictions which are compiled on the basis of observations by the ERS-1 scatterometer radar. Tests of this equipment have been performed in collaboration with Shell and the offshore company Heerema. According to G.J. Wensink of the Hydrodynamics Laboratory, remote sensing technology is presently still ahead of application. "The laboratory's task is to build a bridge between the technology and the market," says Wensink.

According to Dr. N.J.J. Bunnik, head of the Remote Sensing Policy Committee (BCRS), the efforts of the National Remote Sensing Program (NRSP-2) will be "assessed from the operational results." He pointed out that application-oriented research is certainly 10 years ahead of the ultimate introduction of a new technique such as remote sensing. However, further financing of NRSP-2 is not yet certain, as was clear from the speech by Minister of Transport and Public Works Jorritsma-Lebbink.

A committee of independent experts led by former Minister Van Aardenne has recently expressed positive views on the Netherlands remote sensing program. However, the committee does think that its marketing should be improved. The minister announced that he has asked the BCRS to come up with proposals for the second part of NRSP-2, which will run from 1995 until the year 2000. Since 1990 the seven ministries participating in the BCRS have made a total of 33.1 million guilders available for NRSP-2. The individual contributions from the institutions and companies taking part in BCRS projects must also be added to this amount.

Threats are also coming from abroad. Van IJsselstein announced that competitors in larger ESA [European Space Agency] countries have been trying to abolish the so-called "geographical return" in favor of open competition. He warned of "marginalization of the Netherlands contribution" and advocated an active cluster policy in earth observation in order to turn the tide.

**France: PSA's Diesel Engine Modernization Program Presented**

95WS0094B Paris L'USINE NOUVELLE in French  
24 Nov 94 pp 70-71

[Article by A.-G.V.: "PSA Plan To Reduce Cost of Diesel Engines"; introductory paragraph in boldface as published]

[FBIS Translated Text] Diesel engines from the Citroen plant in Tremery should cost 25 percent less by 1988. To achieve that goal, a drastic plan for improving productivity has been put in place.

In Tremery-Nord near Metz, the demand for diesel engines is at a peak. At 3,650 units per day, the specialized plant owned by the PSA [Peugeot Corporation] group and managed by Citroen is operating at full capacity. An additional investment of 20 million francs [Fr] will make it possible to assemble another 400 engines beginning next April at the neighboring plant in Tremery-Sud, which specializes in gasoline-engine engineering. But despite that popularity, the world's largest diesel engine plant has adopted a drastic goal to ensure its competitiveness: the cost of its engines must drop by 25 percent by 1998. A sine qua non for remaining in the race.

**Specific Program With Deadlines**

The cost of producing the 1.9-liter engine used primarily in Citroen's ZX and Xantia and in Peugeot's 306 and 405 is scheduled to drop from Fr10,500 in 1993 to Fr7,900 four years from now (net of inflation). This pilot plant was Citroen's first plant to put figures on a specific program with a deadline for reducing costs. The plan is called Diesel 4000.

Drafting of the plan began in mid-1991, and it was made official in July 1992. It is centered on three ambitions: quality and compliance with production deadlines, fast assembly and reliable means of production, and motivation of the wage earners. Each of the plant's eight sections—four production sections and one each for maintenance, quality, methods, and logistics—has adopted a suitable plan based on the same three goals. In the machining section, for example, a seminar for technicians, supervisors, the most highly skilled workers, and specialized partners (in methods, maintenance, and so on) resulted in the adoption of a five-year plan with specific goals for its various stages, examples being a 40-percent reduction in the number of rejects and assembly defects. Each of the four shops constituting that section (two for cylinder heads, one for crankcases, and one for camshafts) then came up with its own version of the plan. All on the same model.

In one of the two cylinder head shops (five unskilled workers, 27 highly specialized workers, four supervisors, and two production technicians), action plans are reviewed every month at meetings by modules of five or six people, including operators. Among the actions taken

recently are the introduction of new and more reliable motors in the machinery, the constitution of buffer stocks to facilitate maintenance work upstream, and so on.

Batteries of indicators have been instituted: number of rejects, inventory levels, the 10 most common defects noted, absenteeism, and each person's versatility. Besides those collective plans in the shops, operators are gradually adopting individual plans and choosing their personal objectives: increased versatility, for example. Two-thirds of the personnel at Tremery-Nord are already taking part.

Thanks to the involvement of every echelon in sharing—and therefore executing—the Diesel 4000 collective plan, Tremery-Nord expects to increase its output from 42 engines per wage earner per month in 1992 to 60 in 1998. The success of the operation depends on individual motivation, which is made easier by the relatively young average age of the plant's employees: 35 years. Participation in quality circles by the plant's 1,500 employees borders on 60 percent—a particularly high percentage at Citroen. The goal is to reach 80 percent by 1998. What this involves is an intensive investment in training (5.6 percent of total payroll in 1992 and 4.5 percent in 1993 despite the recession).

The program's originator, Jean Wolff, left the management of the SMAE (Eastern Automobile Engineering Company), of which Tremery-Nord is a part, in July 1993 and is now Citroen's product manager. Now 54 years of age, this graduate of the Polytechnic School expresses his ambition for the company as a whole: "We have given ourselves five years in which to make our plants among the best in the world in terms of quality and productivity." A hard core of about 15 people is working to that end. A tough gamble. A 20-percent gap in competitiveness still exists between Tremery, which is one of the PSA's most efficient plants, and the best Japanese units.

**France: Renault's Virtual Stamping Process Validated**

95WS0114A Paris LE MONDE INFORMATIQUE  
in French 25 Nov 94 p 14

[Article by Thierry Parisot: "Renault: Virtual Stamping Enters Industrial Phase"]

[FBIS Translated Text] To reduce parts design times, Renault has developed powerful numerical simulation software. Stamping's implacables have yet to be convinced of the interest of these tools.

"The stamping of automobile body parts is on the critical path in the planning of automobile projects," says Mostafa El Mouatassim, a Renault mechanical engineer. "For several years now, Renault has been seeking to shorten this stage by using some of the niche's most advanced state-of-the-art softwares.

"In 1985, cognizant of the interest of numerical simulation of the stamping process, Renault decided to invest rapidly in this research, and began working on it with the CNRS [National Scientific Research Center] and several universities. The object was to introduce an innovative technology for the new generation of engineers, based on the know-how of experienced stampers.

"Until 1989, the work consisted of sensitizing the stampers to convince them that 'the software is not going to replace them.' The initial demonstrations, in 1993, were convincing and enabled the validation of the software. Today, numerical simulation of the stamping process has entered a phase of industrial exploitation, pursuant to a Renault in-house initiative. The stamping process consists of three stages. First, the style (design) engineers define the shape of the vehicle. In the second stage, the product designers digitize the parts using Matra Datavision's Euclid CAD software (also used by Lotus Formula 1 stable). An initial approximate simulation, followed by a few minutes of computation, permits validation of the parts. This initial simulation is done on a Silicon Graphics station with Simem 2 software (used by Fiat), distributed by Simtech. The third stage consists of a complete simulation, taking into account the real conditions of the stamping process." Renault uses two software programs: Dynamic Software's Optris to process the small- and medium-area parts, via a very user-friendly interface; and ESI's Pamstamp for the large-area parts such as the body sides and floor panels. Used on a Cray YPM 4e, supplanted early on by a scalar computer, Pamstamp, through an adaptive meshing technique, reduces computing time to half and, in the case of certain parts, to one fifth.

The complete simulation consists of four main operations: the meshing, the parametrizing of the mechanical data, the design (evolution of thicknesses, deformations, constraints, bends, stamping stress), and the stamper's interpretation of the results obtained. But these operations are memory guzzlers. One stamping animation presents, on average, 15 images that take up between 20 and 200 Mo [million octets (8-bit bites)] depending on the size and complexity of the part.

After a year of utilization and validation, the cause appears won. "Although there are still implacables at Renault, the decision makers are convinced," says Mostafa El Mouatassim. There remains to convince the skeptical stampers to accept the transition from a caressing of the parts to a caressing of the keyboard!

#### **Porsche Develops Family Auto Concept for China**

95WS0079C Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 22 Nov 94 p 8

[Unattributed Article: "Porsche Develops Family Auto Concept for China—Long-Term Cooperation to Develop Autos Includes Chinese Experts"]

[FBIS Translated Text] Together with the People's Republic of China, auto maker Dr. Ing. h.c.F. Porsche AG wants to develop a family car based on the C88 concept. According to the company, this means including Chinese technical personnel, designers and businessmen in the complex development process from the very beginning. The company made this announcement at the Family Auto Congress in the Peking World Trade Center where 18 car manufacturers from all over the world presented their suggestions for a people's car for China.

Porsche wants to provide the Chinese experts with one year of language and technical training so that they will be able to develop the car in Weissach together with Porsche engineers. The company also plans to include trainees in the program. At the same time, the production facilities in China could be planned and constructed.

Based on this schedule, the first purely Chinese family car could roll off the conveyor belt by the turn of the century, as Porsche explains. Furthermore, this type of cooperation includes the vision of training the Chinese experts in Germany so that later on China could have an independent institute modelled after the Porsche research and development center in Weissach.

The family car C88 designed by Porsche is intended strictly for transporting passengers and for commercial use. The C88 development model is a four-door notched back sedan, 5.05 m long, 1.64 m wide and 1.43 m high. Porsche lists an empty weight of 980 (including 40 liter fuel).

A transverse 1.1 liter four-liter-cylinder/four-cycle/four-valve gasoline engine with 50 kW and a five-speed transmission is in the plans. Fuel consumption based on three driving modes is 5.8 liter; it reaches a maximum speed of 165 km per hour and accelerates from 0 to 100 km in 16 seconds.

The price for the first version with 35-kW engine power, two doors and a hatchback will be about 8,000 German marks [DM]. A second series is described as a standard and luxury model. There are also plans for two- and four-door liftback versions as well as a station wagon and a pick-up version. Prices range between DM10,500 and 11,500.

The four-door version with a notched back, which will probably count among the luxury models in China, will cost about DM14,000. The third version will be based on international standards and is also planned as an export model. However, the two other designs are to meet European crash test requirements as well.

According to Porsche, dividing the family car concept into three models will provide the best long-term basis for making people's cars widely available in China. An initial annual production of 300,000 to 500,000 vehicles is planned. The first family cars are to come off the production line in 1998.

**Italy: Aircraft Industry Reorganized**

95WS0079B Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 22 Nov 94 p 2

[Unattributed Article: "Italy's Aircraft Industry to be Reorganized—Streamlined and Flexiole—Aircraft and Space Technology Under Finmeccanica"]

[FBIS Translated Text] Despite Italy's political and financial difficulties, the reorganization and financial recovery of the Italian aircraft industry is making great progress. At least this is the impression one gets from discussions with most of the industry's companies. The reorganization, which was long overdue, aims at a more streamlined organization avoiding duplicate and parallel work and also offering greater flexibility in many companies and company divisions. In previous years, the task areas of the various companies in this Italian industry were very similar, and separating lines were hardly noticeable.

As in nearly all other European countries, the concentration process of the Italian aircraft industry, which has come a long way, is based on the realization that the funds required for developing new civilian and military products are so large that competition within one country is no longer feasible and that even individual countries must come together in larger units in many areas so that the aircraft industry can survive.

By now, the Italian industry is almost completely under the roof of Finmeccanica. This group of companies consists of the technically more advanced firms of Italy's state enterprises, which are combined under the Italian holding company IRI [Institute for the Reconstruction of Industry]. The reorganization process is to be completed by spring 1995. The primary company of the newly organized industry is Alenia, a company which was founded in 1990. It combines aircraft construction, the building of space equipment and advanced related electronics. The predecessor companies, Aeritalia and Selénia, no longer exist.

The construction of civilian and military aircraft and components accounts for about 50 percent of Alenia's

business. Alenia is primarily a supplier for Airbus, as well as Boeing and McDonnell Douglas. On the civilian side, Alenia works more independently and manufactures the ATR regional commercial aircraft together with its French partner Aerospatiale. At present, negotiations with the British Aerospace Corporation are under way regarding a merger with its Jetstream division. If this should go through, the expanded group would be the strongest European supplier of regional commercial aircraft. In the military field, Alenia is a member of the Tornado consortium together with the Federal Republic and Great Britain. The same is true of the follow-up model, the Eurofighter or previous fighter 90. On the military side, there are concerns regarding job security, since the Tornado production will be discontinued in the foreseeable future and the in-house transporter program G222 and the in-house AMX trainer cannot be produced much longer. At the same time, the production of the Eurofighter has not yet started.

The other half of Alenia's business activities is divided among systems technology, such as complete aircraft safety installations, space and communications technology, aircraft engines and marine technology. Of these, systems technology is the most important one, partly because the manufacture of guided weapons in Italy has been concentrated almost completely in this sector. According to Alenia, this was done primarily to integrate the Italian industry more easily into a European reorganization of guided weapons construction. Alenia's jet engine construction is basically the previous Alfa Romeo aircraft engine construction. In the fields of space and communications technology, Alenia cooperates closely with Marconi of Great Britain.

In addition to Alenia, Finmeccanica includes helicopter producer Agusta, weapons producer Oto Melara and Fiat Avionik. The latter is increasingly becoming a focal point of Italian avionics. All companies are remarkably independent in their decision making. However, in practice, this freedom may be limited when it comes to large investments, since the funds available within Finmeccanica are not only limited, but also sought after by a large number of companies.



**Germany: Protein Synthesis Without Gene Manipulation Studied**

95WS0079D Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 22 Nov 94 p 8

[Unattributed Article: "Protein Synthesis Without Gene Manipulation—Development of a New Bioreactor in Berlin—Purification not Necessary"]

[FBIS Translated Text] The Free University of Berlin has developed a reactor which is able to synthesize proteins continuously without bacteria. The bioreactor consists basically of a small reaction room for protein synthesis. The wall has several holes for supplying the initial products and for removing the proteins. An ultra filtration membrane ensures selective withdrawal of the proteins. The impurities remain in the reactor, as Professor Dr. Volker Erdmann reports (Institut fuer Biochemie, Thielallee 63, 14195 Berlin).

The bioreactor imitates the protein synthesis of a living cell. The genetic substance DNA is first transcribed to ribonucleic acid (RNA) and then translated to the respective proteins using ribosomes which are special protein particles. For this purpose, a cell needs energy-containing compounds and amino acids in addition to DNA and RNA. The researchers in Berlin have isolated some of these components from cell cultures and introduced them into the reactor. There, the proteins are produced the same way as in a biological cell.

According to reports, this type of protein production has several advantages. The costly purification which is

required when proteins are produced with genetically engineered bacteria is not necessary. The proteins are not contained in a mixture of cell components and cell walls, but can be obtained from the reactor in a highly pure form. In addition, they display more activity. This is probably due to the absence of purification which results in a higher concentration of the desired proteins, but reduces their activity at the same time.

The reactor can also be used to produce proteins which cannot be made in cells. These include toxic and non-soluble proteins. In view of the laws regulating genetic engineering, the researchers see another major advantage: there is no danger of genetically-engineered bacteria escaping into the environment. Therefore, the approval process for operating the reactor will probably be less complicated.

The system is designed for continuous operation. With the flow-through method, yields of up to 100 micrograms of protein per milliliter are possible. The proteins which have been produced this way include various enzymes, membrane proteins and a growth hormone.

The proteins can be used in many applications. Membrane proteins of pathogens, for instance, can be used for the production of vaccines, hormones can be used for therapy, and specifically changed proteins can be used for diagnostic biosensors. Optimized enzymes can also be used for diagnostic purposes or for the production of medicine. Other proteins can be used in bioinformation technology.



**France: Creation of Advanced CD-ROM Reported**

95WS0098B Paris L'USINE NOUVELLE in French  
1 Dec 94 p 40

[Article by Francois Savatier: "Storing 140,000 Images on Disk"]

[FBIS Translated Text] Diffractive optical memory, developed by Imagine Technologies and the Photonic Systems Laboratory of the University of Strasbourg, has enormous graphical information storage capacity. The primary application? Video.

Today's CD-ROM disks can hold at most the equivalent of a few hundred books. But that capacity is exhausted quickly when storing graphical information. Despite all the compression technologies in the world, image digitization creates a flood of data that overwhelms ordinary storage equipment.

According to Imagine Technologies, a small Toulon-based company, the answer is optical storage. As engineer Harry Ramenah explains, "In an emulsion 10 micrometers thick and 1.2 square centimeters in surface area, we can store 1,120 images in a three-dimensional matrix (7 by 10 by 16). The resolution we achieve, 512 by 512 dots, is practically as high as television."

How are these images "layered" in the emulsion? Imagine Technologies adroitly exploits the potential of the bichromated gelatin used for holography; 64 square centimeters, equivalent to the surface area of a 3-inch diskette, can hold more than 70,000 images. "But that's only the start," says Ramenah. "With emulsions 25-30 micrometers in thickness, more than 140,000 images could be stored on the same surface area—equivalent to 400 to 500 books, or a hundred full-color books." Data is recorded onto the disk using a technique called "angular multiplexing"; two coherent laser beams (from the same source) carry the information to be recorded. The first, unmoving, is introduced, with the help of a waveguide, into a "liquid crystal optical valve." The valve, placed in front of a screen, instantly generates an image in the liquid crystal identical to that on the screen. The scanning beam then hits the image before being reflected. The second laser beam, serving as the reference beam, hits the emulsion at different angles controlled by an assemblage of mirrors. The angle determines the "depth" at which the image is stored in the emulsion. After allowing about 10 minutes for development, the image can be played back. Playback is instantaneous when the reference beam is directed onto the surface at the angle corresponding to that of the selected image. In passing through the disk, the beam "picks up" the image, which can then be projected. What about color images? All that's required, by way of pre-processing, is to filter out the red, green, and blue images forming the base of the digitized image and record them separately. A fourth "image" of digitized sound is generated by the computer and recorded. With this system, the 140,000 images storable on a disk (81 square cm) are equivalent to more than an hour of video!

But Imagine Technologies is not limiting itself to video. The small company is preparing the initial prototype of a compact rapid recording and playback device. And it foresees numerous applications: archiving of graphical data, photographs, and x-ray images; preparation of identity cards combining photography with finger and voice prints; and even a map-reader that automatically projects the image onto a windshield.

[box, p 40]

**Company Described**

Toulon-based Imagine Technologies was founded in October 1990 by Paul Bertrand, a former ONERA [National Office for Aerospace Studies and Research] engineer who specialized in underwater detection equipment. After doing a lot of work for the military sector, the small company in the last 2 years has focused on civilian technologies. In January 1993, USINE NOUVELLE listed it as one of the country's "top innovators" for its aerial sonar device that allows one particular sound to be selected for monitoring. The company employs six people and has annual sales of 3 million francs.[end box]

**Germany: Software Developers Anticipate Rise in Market in 1995**

95WS0096B Munich COMPUTERWOCHE in German  
18 Nov 94 p 12

[Article: "German Software Developers Have Passed the Bottom of the Valley"]

[FBIS Translated Text] Munich—Optimism was the mood of the German Software Day. A prognosis of an increase in product sales of seven to nine percent for the current year was made by the Bundesverband Bureau und Informationssysteme e. V. (BVB) at the event in Frankfurt, which was organized with the BVIT (Bundesverband Informationstechnologien). However, services are projected to increase only four to six percent.

Klaus-Dieter Laidig, member of the Board of Directors of the BVB and managing director of HP, sees particularly rosy prospects in the areas of databases and development environments (1993 sales of about 1.6 billion German marks [DM] in Germany), horizontal applications (DM3.2 billion), and vertical, field-directed applications (DM3.6 billion).

"One can get relatively far ahead in the international market even as a German supplier," Laidig encourages the software developers. This is demonstrated, so he says, by the success of big suppliers such as Software Ag or SAP. While no European enterprise can be found worldwide among the ten biggest system suppliers, he continues, the two software companies range worldwide among the top ten suppliers of standard products.

Laidig points out several factors, which he misses in small and medium enterprises, as prerequisites for such

top positions. These small and medium enterprises, he feels, lack a visionary outlook at market development and clear strategies for innovative products. Some software companies, according to Laidig, lack the courage to replace existing software products "in full flower of their success." The time span between idea and readiness of a product must also be shortened, according to the views of the HP chief.

The necessary acceleration of product innovation can be achieved only by clear specialization and by strategic partnerships, according to the views of BVB and BVIT. With this, the range of possible cooperation reaches from joint development to marketing and sales partnerships. According to BVB, SAP is achieving half of its sales via partnerships with Price Waterhouse, EDS, and others.

The German software suppliers have recognized the signs of the times, says Reinhard Pelz, managing director of Heyde & Partners in Bad Nauheim for the co-organizer BVIT, and points to a continuously increasing number of mergers and cooperatives. Some of these have been initiated at an exchange which has been established for this purpose.

#### **German-Japanese Cooperation in Supercomputer Development Reported**

95WS0051A Leinfelden-Echterdingen COMPUTER ZEITUNG in German 20 Oct 94 p 3

[Article by Uwe Harms: "Japanese-German Cooperation in Supercomputing—NEC and GMD Join Efforts in Parallel Processing Research"]

[FBIS Translated Text] *Scientists of the Japanese company NEC [Nippon Electric Corporation] and the Society for Mathematics and Data Processing (GMD) are working together in the recently opened Research Center for Computers and Communications (C&C) in Bonn-St. Augustin.*

The Japanese-German research team in Bonn is concentrating on parallel processing. Research goals include the exchange of knowledge and methods and the creation of a broad common knowledge base in parallel technology. NEC invested one million dollars in laboratory equipment alone, and this initiative is also expected to yield tangible results: typical scientific algorithms are to be implemented on parallel computers to speed up operations, tools are to be created in order to standardize similar transfers to parallel technology. Furthermore, it is expected that parallel processing will greatly benefit applications which use various visualization technologies. And finally, related areas such as multimedia communications are to be expanded to support human communications.

In addition, research is going on in numerical simulations as a new means for investigating technical or physical processes. With this cooperative effort, NEC has decided to use the parallel processing expertise GMD gained from the Suprenum research which was government-sponsored but failed.

The Japanese consider parallel processing to be the future of technical and scientific computing. At the same time, they realize that a lack of software is the greatest obstacle. The parallel processor Cenju-3 by NEC (named after the multi-armed Buddhist god Cenju) has been installed as a 64-processor version and reaches a top performance of more than three gigaflops. In the opening ceremony Professor Ulrich Trottenberg stated that parallel processing has now overcome the acceptance hurdle. Many applications are inherently parallel—the hardware is available—and that the problems with software and algorithms can be solved is evidenced by basic changes in algorithmic thinking as well as transfers of existing programs. According to Trottenberg, transferability of application software to various computer platforms as well as standardization of parallel processing at the voice or message passing level are essential prerequisites.

According to Trottenberg solutions are at hand, and he characterized the acceptance problems as the typical chicken/egg problem: industry is waiting for parallel application programs from software developers, while the software houses are waiting for industrial users. He mentioned the weather forecasting program of the European Weather Center in Reading as an example that portable and effective parallel processing of a large application (approximately 200,000 program lines in Fortran) is indeed possible. Using the PARMACS program libraries and macros the program can now be processed on all computers which run under the PARMACS operating system.

The installation of PARMACS on the Cenju 3 computer is one of the primary goals of the cooperative effort between NEC and GMD. The C&C laboratory will start with six researchers, an equal number from each partner. By 1997, this number is to increase to 20 researchers.

NEC has many years of experience in the area of supercomputing. According to Nobuhiko Koike, head of the laboratory, NEC was the first manufacturer to break through the gigaflop barrier with the vector computer SX-2, and through the ten-gigaflop barrier with the follow-up system SX-3. The SX-3 is used by the National Swiss Computing Center (CSCS) in Manno, by the Dutch Aerospace Laboratory (NLR) in Amsterdam (both also use the Cenju-3 parallel computer) and by DLR [German Aerospace Research Institute] in Goettingen. NEC is closely cooperating with these renowned institutions as well.

The most recent cooperation between NEC and GMD will benefit both partners. NEC can utilize the substantial know-how GMD has in the development of software tools and application programs and in running such computers. The computer inventory at St. Augustin can almost be called a "parallel zoo"; it includes the NEC Cenju-3, a CM-2 and a CM-5 by Thinking Machines, a Meiko CS-2, an IBM SP2 and the Manna computer in Berlin which was developed in-house. In addition, the

new research team is able to access parallel computers at the nuclear research institution Juelich where several Cray multiprocessor systems and an Intel Paragon are available.

**Philips Expands Production of Liquid Crystal Displays**

95WS0117A Frankfurt/Main FRANKFURTER  
ALLGEMEINE in German 10 Dec 94 p 20

[Article: "Philips Banks on Liquid Crystal Displays"; subheads: ""8-Percent Market Share Hoped for in Year 2000"; "Broad Supply"]

[FBIS Translated Text] Flat Panel Display Co. (FPD) in Eindhoven, the manufacturer of flat screens for display panels, whose majority shareholder is the Netherlands electronic firm Philips, projects excellent opportunities in the business with active-matrix liquid-crystal displays (AMLCD). At present, the firm is the only noteworthy producer of AMLCD outside of Japan where market leader Sharp currently produces more than 90 percent of such displays. Precise data on the actual current market position are not obtainable although the FPD is striving for an eight-percent share on the world market by the year 2000. Chris Stuve, a corporate director, asserted this during a plant inspection.

In Eindhoven, an annual growth rate of 30 percent is projected for the AMLCD displays market, banking, above all, on a sizable demand for portable PCs [personal computers] and computer games. According to vice-president Ruud Sleijffers, the market is expected to grow from a current eight million units of portable PCs to 23 million units in 1999. Based on his data, in 1993 the total market for all screens totaled \$19.1 billion.

The share conventional screens held therein was more than 70 percent, while "active LCDs" [liquid-crystal displays] realized a 12-percent share. In the year 2000, the market for new screen technologies is projected at \$35.6 billion, with active LCD displays then purportedly holding a 24-percent share. At the projected growth rate of 30 percent, the AMCLD business would then grow to 14 billion guilders from the current five billion guilders (4.45 billion German marks [DM]), including an additional drop in prices.

Besides Philips, that holds 70 percent of the shares in the joint venture FPD that was established in Eindhoven in 1993, the two French electrical engineering firms of Thomson and Sagem each have a 10-percent participation the same as the German chemical firm, Merck, that joined in July of this year. The Eindhoven plant started up serial production only this year. At present 40,000 26.4-cm [centimeter] diagonal display panels are produced there each month.

In a second stage of expansion, the desire now is to raise monthly production to 75,000 display panels. Also being pondered is the erection of a second manufacturing plant that would be located in the Far East, however, close to

the principal sales market. Also in Eindhoven the search is on for new partners. Currently, 40-50 percent of the Eindhoven output is being sold in Europe, 30-40 percent in the U.S. and the rest in Asia.

At the end of the second phase of expansion, FPD shareholders will have invested 500 guilders [as published] in the pilot plant and the manufacturing plant. The firm currently employs 650 employees, 130 of whom are engaged in research. The form of the joint venture is characterized in Eindhoven as crucial for all four partners both for reasons of cost sharing in a fast growing and capital intensive industry and also from a strategic-technological perspective and for the sake of easier market access. Portable computer games, above all, are viewed as a major growth market for the future. FPD is also betting on the automotive sector, including here the highway traffic navigation systems. The desire also is to present a broad menu of available display panels having a multi-diversity of fields of application.

**Netherlands: Delft University Develops Parallel Computer**

BR0301152495 Amsterdam COMPUTABLE in Dutch  
16 Dec 94 p 2

[Unattributed report: "Delft Technical University Develops Own Parallel Computer"]

[FBIS Translated Text] Amsterdam—Last week, the Technical University in Delft inaugurated a powerful parallel computer for molecule simulations. The computer, termed Delft Molecular Simulator (Demos), contains 32 processors.

The Delft university developed this big computer itself because it outranks the National Supercomputer Facilities (NSF) in computing speed as well as in cost.

In addition, the computer is available to the scientists 24 hours a day, whereas the NSF computer needs to be shared with others.

**Switzerland: Optoelectronic Switching of Neuron Cell Studied**

95P60030A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 11 Nov 94 p 8

[Unattributed article: "Several Hundred Cells Can Be Integrated On One Chip"]

[FBIS Translated Text] The Swiss Paul Scherrer Institute is one of the first European research and development laboratories to have developed a new type of optoelectronically-operating circuit in the form of a neuron cell. It could be used as the basic component to build multi-cell photonic circuits and consists of light-emitting diodes, transistors and photodiodes. An individual cell measures 300 by 200 microns and functions similarly to

the neurons of the nervous system. Such cells are designated as "smart pixels" because of their capabilities and small size.

The cell can be put by the hundreds on a single chip. [When the cells are] interconnected in the appropriate hierarchical work levels, complex neuronal networks can be designed, which can perform difficult switching tasks much faster than most of the circuits used today, which operate purely electronically.

Since, however, silicon can hardly be used as a semiconductor material for light-emitting circuits, the photolithographically fabricated circuits consist of so-called III/V semiconductor materials, mainly [of] gallium arsenide compounds together with aluminum, which can constitute up to 80 percent of the alloys. The light-emitting and detecting components used reach switching outputs in the range of up to 2 picojoules in previous experiments.

As experiments have proved in the meantime, however, the light-emitting diodes used are not powerful enough to interconnect a large number of these cells. Therefore, future work will be concentrated on the development of semiconductor lasers with higher light intensities and improved switching performance. Only when this work has been successfully concluded will one proceed to reduce the geometry and size of individual cells in order to test in practice a chip with a multitude of cells, reports the Paul Scherrer Institute (CH-5232 Villigen, Switzerland).

In about five years, the global market (outlook) for future optoelectronic circuits will be several million dollars, according to available estimates. Optoelectronic circuits permit extremely fast data transmission networks or represent a new generation of optoelectronically functioning computer switches. They utilize the high speed of light and its high frequencies. Moreover, they are less interference-prone than purely electronically-operating circuits.



**France: Hypersonic Propulsion for Cruise Missiles**  
*BR2012134794 Paris LE BULLETIN DU GIFAS*  
*in English 24 Nov 94*

[Unattributed article: "Supersonic and Hypersonic Propulsion for New-Generation Cruise Missiles"]

[FBIS Transcribed Excerpt] Hypersonic propulsion by ramjet engines will enable new-generation cruise missiles to fly faster and farther. They will achieve speeds of Mach 5 and more at ever higher altitudes, and offer a significant manoeuvring capability.

France is in a strong position in this field and the prospects for the future are promising. Aerospatiale-Missiles is the only Western missile manufacturer with a full understanding and long-standing experience of ramjet technology and the only one to offer operational solutions.

Current research projects are being conducted on derivatives of the ASMP [medium-range air-to-surface missile], the ANNG [new-generation anti-ship missile] and the ASLP [long-range air-to-surface missile]. [passage omitted on functioning of ramjet technology]

**Examples of Supersonic Missiles Under Development by Aerospatiale**

**ASURA:** Derived from the ASMP, the ASURA (Air-to-Surface Using Ramjet and Autoguidance) is a supersonic missile flying at Mach +3.

ASURA is Aerospatiale's response to the need expressed by the United Kingdom to equip its strike aircraft with a conventionally armed stand-off air-to-surface missile (CASOM) for its ground attack aircraft.

It is a lightweight, compact missile weighing 885 kg and measuring 5.42m. Low observable technologies and a flight altitude of 20,000m (65,000 ft) make the ASURA invulnerable in cruise flight. It is designed to cover 400km in just 7 minutes.

**ANNG:** The ANNG new-generation anti-ship missile is designed to follow on from the French Exocet and the American Harpoon.

Available from 2002, the delivery date for a large number of new ships across Europe, this supersonic missile will provide two to three times better performance than current anti-ship missiles.

- Mach +2 flight instead of Mach 0.8, better stealth, agility and resistance to countermeasures
- twice the destruction capability, through the combined power of its warhead and the kinetic effect of impact at supersonic speed,
- twice the range: 150 km+

Aerospatiale has evaluated the market in European NATO countries alone at 500 to 1,000 surface-to-surface

missiles between 2002 and 2012. The first European requirements have been identified in France, Germany and the United Kingdom.

**Aerospatiale's Involvement in Hypersonic Propulsion**

Aerospatiale's general policy in this field is to conduct preliminary design work on air-breathing launchers at a sufficient level to carry out a complete initial design loop in 12 to 18 months.

Ongoing projects are the joint responsibility of the Space and Defense Division (vehicles and rear sections) and the Missiles Division (air intakes and motors).

The primary aim of the Missiles Division's involvement in this work is to apply these technologies to very high-speed missiles powered by ramjet- and scramjet-based air-breathing propulsion systems.

The two divisions are working in the following areas:

- ramjet-based air-breathing combined motors used as the power plant for the space launchers being developed within the Space and Defense Division
- active cooling of the structures of these motors by cooled air and ergol
- hypersonic flight demonstrator vehicles to validate propulsion capabilities beyond the limits possible with ground simulation (Mach greater than 8)
- investigations into the sizing of the new test facility
- new numerical calculation codes associated with these vectors.

Aerospatiale-Missiles is also working with or for CNES [National Center for Space Studies] (jettisonable ramjet engine for space launchers, methodology for testing ramjet engines up to Mach 6) and ESA [European Space Agency] (space launcher, hypersonic air intake). In addition, the Missiles Division is taking part in the PREPHA programme (advanced hypersonic propulsion research programme) alongside ONERA [National Office for Aerospace Studies and Research], SEP [European Propulsion Company], SNECMA [National Company for the Study and Construction of Aircraft Engines] and Dassault Aviation.

**Aerospatiale's Test Facilities**

Aerospatiale's Bourges-Subdray research establishment operates the only missile ramjet testing facilities of their kind in Europe. They can reproduce flight conditions at speeds of Mach 2 to Mach 5+. A new hypersonic ramjet testing facility designed and built by Celerg under contract to Aerospatiale will be used to test performance at Mach numbers of more than 6 (6.5).

As well as running these tests, Celerg is producing a prototype Mach 8 adiabatic compression heater which will be used to prepare for future test programmes. The new hypersonic test line uses a hydrogen burner to heat



the air. To overcome problems connected with the water vapour produced during hydrogen combustion beyond Mach 7, Aerospatiale-Missiles and Clereg are developing a new concept of high-enthalpy free air generation based on adiabatic compression.

The concept has been validated on a reduced-scale demonstrator, and free air streams of more than Mach 8 can now be envisaged.

### France Announces Three Missile Development Programs

BR2012150994 Paris LE MONDE in French 17 Dec 94 p 15

[Report by Jacques Isnard: "France Launches Three New Long-Range Precision Missile Programs"]

[FBIS Translated Text] Defense Minister Leotard decided on Thursday 15 December to immediately begin a feasibility study of an Apache anti-infrastructure missile (produced by the Matra-Defense group) and an ANNG [New Generation Antiship Missile] supersonic antiship missile (designed by the Aerospatiale group). Francois Leotard requested that these two programs be capable of being conducted in cooperation by the two companies, with or without the collaboration of European groups interested in the project obtained by the French. This double decision, accepted by the chief of staff of the Armed Forces, the general delegate for weapons, and the chiefs of staff of the Air Force and the Navy, does not prejudice next January's decision on the French cruise missile program, similar to the Tomahawk missile already in service in the United States.

Some time ago, France ordered from Matra-Defense a so-called neutralization weapon, the Apache-A, designed to destroy landing strips. This air-to-ground missile, which carries submunitions which blow up airfields' asphalt, does not need to be very accurate and is of short range (about 150 kilometers). It is co-financed and co-manufactured in equal parts by Matra-Defense and Aerospatiale.

Based on this weapon, Matra-Defense designed an anti-infrastructure Apache air-to-surface missile, to arm Mirage 2000 or Rafale aircraft and having a range of around 400 kilometers once launched. It should be a much more accurate missile (on the order of a few meters from impact) and is designed to destroy an adversary's sensitive points before any later decision on a larger-scale "air strike." The Apache anti-infrastructure missile is a weapon which France could use in an international, or even regional coalition. This means that it will receive the American GPS (global positioning system), enabling it to have accurate navigation through readjustment, and it will be economical, to enable its deployment in large numbers as needed. This is the weapon on which Mr. Leotard has settled, and whose production he has entrusted to Matra-Defense. This anti-infrastructure Apache is a subsonic missile, using "stealth" technology

(reduced radar detection). After having opted for Matra-Defense, the defense minister chose the Aerospatiale group for the second program, that of the ANNG antiship supersonic missile, considered a new-generation one compared to the first ANS [supersonic antiship missile] design.

### Successor to Exocet

This is a surface-to-surface missile, designed to sink enemy vessels, which could be considered the successor to the Exocet. This weapon will outfit surface vessels and submarines. The ANNG program is largely supersonic and favors speed at wavetop level (at a few tens of meters from the surface) to escape interception from the radars on the target. For its propulsion, the ANNG missile uses the ramjet engine, which is a globally recognized specialty of Aerospatiale.

During his meeting with his main collaborators, the defense minister also asked to be given next January a "launch document" spelling out the consequences of the French choice in the cruise missile area. It is known that the general staffs favor a missile inspired by the technology of the American Tomahawk, widely used during the war against Iraq in 1991, labeled by France the APTGD (very long-range precision weapon). It is a new program, completely different from the other two.

For now, Mr. Leotard's choice in principle is a subsonic APTGD subsonic missile, derived from Matra-Defense's Apache, against a supersonic missile (labeled ASURA [Air-to-Surface Using Ramjet and Autoguidance] and based on the nuclear-warhead ASMP [Medium-Range Air-to-Surface Missile] missile which equips the Mirage 2000 and the Super-Etendard) of the Aerospatiale group.

This APTGD missile is complementary to the Apache anti-infrastructure missile, and will equip aircraft of the Navy or the Naval Air Force, as well as surface vessels. It will have an independent ability to acquire its targets with an extreme accuracy and a range exceeding 400 kilometers. "Stealth," flying at very low altitude and at subsonic speed, the APTGD will have a bimodal guidance (radar and infrared image), which, in the final version, will give the missile a trajectory—to the meter—in unfavorable atmospheric conditions. Its mission will be to guarantee selective "strikes" during a delicate phase of the management of a crisis.

Thus, in contrast to the Apache anti-infrastructure missile which will have a saturation effect, the APTGD will enable, if one believes Matra-Defense's engineers, the mission to be performed with a single missile, minimizing to the greatest extent possible the so-called "collateral" damage to civilian populations. It will carry a powerful, non-nuclear explosive payload.

In presenting his decisions, Mr. Leotard observed that "this is the first major application of the concept of the use of conventional forces within the framework of a

strategy of action, based on theories of engagement of forces contained in the White Paper" presented last April by the government.

For the chief of staff of the Armed Forces, the APTGD missile is part of a strategy aimed at destroying a target deep within an enemy's resources. It should thus be given two primary missions: On the one hand, to send a strong and selective signal to a troublemaker, by showing him his vulnerabilities

before the crisis degenerates; on the other hand, to go after vital installations, to prepare or accompany a more vigorous offensive operation. This is why it is not planned to produce a large number of the APTGD. Some 200 weapons in all are mentioned.

Mr Leotard has given himself until January 1995 to confirm his choice of a subsonic APTGD derived from the Apache "based on the results of a financial negotiation with the industry."

**France: PVC Recycling Studied**

95WS0080A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 22 Nov 94 p 8

[Article by nrb: "Pullovers Made of Recycled PVC"]

[FBIS Translated Text] Pullovers made mostly of recycled polyvinylchloride (PVC) are currently coming to market in France. The material is made from about 27 PVC mineral-water bottles. Together with 30 percent wool, it forms the textile for a pullover that will cost between 175 and 230 German marks. If the product appeals to fashion-conscious French consumers, this could be a considerable contribution to PVC recycling in France. Today, only about 200 million bottles are recycled from the 3.2 billion bottles used.

The companies Elf-Atochem and Rhovyl developed the pullovers. According to claims by these companies, the recycled PVC has a purity of 99.8 percent. This is necessary because the jets of the spinning machines would become clogged if particles larger than 20 micrometers are present in the PVC melting stock. The PVC does not contain any other impurities from paints, screw caps made of other types of plastic, adhesives, paper labels, or stabilizing agents.

The purity is achieved in that the molten PVC is filtered and washed with solvents, reports the magazine NEW SCIENTIST (1994, No. 1947, p. 26). Virtually every step of the processing method was changed slightly as contrasted to pullovers made of normal PVC, said Alain Regad, the president of Rhovyl. As the processed material has a blue tint, the coloring process also needed to be optimized.

**Germany: Biomass Technique Developed to Produce Energy**

95WS0080B Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 24 Nov 94 p 8

[Article by ghi: "The Energetic Utilization of Biomass has Yet to be Solved Satisfactorily. Schulze Lammers: The Combustion Gases and the Condensate Contain Too Many Pollutants"]

[FBIS Translated Text] Plants to incinerate biomass have not in general been developed to the point where they can achieve the low emission values that characterize advanced incineration plants for fossil fuels. This point was made recently by Professor Peter Schulze Lammers (Institute for Agricultural Engineering, University of Bonn, Nussallee 5, 53115 Bonn) in a presentation to the Food and Agricultural Organization (FAO) of the United Nations.

The hazardous components in flue gas can only be reduced to levels acceptable in countries having appropriate environmental legislation if advanced technologies are used. Particularly critical is the emission of

carbon monoxide. This could reach more than 200 milligrams per cubic meter of flue gas.

The wood-like cellulose compounds are what make biomass appear suitable for incineration and gasification. Almost all of these materials contain 40 to 50 percent carbon and just as much oxygen. The sulfur content of dry biomass, on the other hand, is considerably below that of coal or oil, explains Schulze Lammers. However, because its energy content is three to four times lower, the emission of sulfur compounds could reach the same level as for fossil energy sources.

The heating value of dry biomass, regardless of its origin, is between 15 and 19 megajoules per kilogram. Plants that do not produce grains or seeds may contain up to twice the energy of cereals. However, if the moisture content is very high, such as is the case for wood, for example, this reduces the energy yield considerably. In most cases, consequently, incineration must be preceded by a drying process.

Material consisting of cellulose, hemicellulose, and lignin burns in a characteristic manner that must be considered when improving the incineration process. First, the volatile components gasify and incinerate. These make up 72 to 85 percent of the mass. Then, the remaining charcoal burns.

On average, four cubic meters of combustion air are needed for one kilogram of biomass. This results in a flue gas volume of 4.5 to 4.8 cubic meters. To incinerate completely and limit dangerous flue-gas emissions, high temperatures are important. The downstream boiler must provide a sufficiently large heat exchanger surface so that the particles can drop out of the flue gas due to the effect of gravity.

Incinerating wood chips and cut straw yields greatly differing carbon monoxide values, according to the determination of Schulze Lammers. To limit particle emissions, he considers downstream filters or cyclone systems a necessity. In the case of large incineration plants, the sulfur-dioxide emissions must also be monitored.

Comparing the amount of carbon dioxide entering the combustion process to that emitted allows biomass to appear as a "neutral" energy source. Schulze Lammers, however, considers this relationship on a grander scale. According to his observations, to obtain five units of biomass energy and the consumption of one unit of fossil energy (during harvesting, transport, preparation of the materials and operation of the incineration plant), 80 percent less carbon dioxide is released than for incinerating fossil energy sources alone.

Besides incineration, gasification is considered the second basic method to exploit biomass. The gaseous reaction products have only a low heating value of three to five megajoules per cubic meter. The gas can be burned directly in spark-ignition or diesel engines. The

gasification process can be better monitored using a two-stage combustion process, says Schulze Lammers.

In the first stage, the charcoal and volatile materials of the gas fraction of the organic material are oxidized. In the second stage, the combustion gases coming from the first stage are oxidized. With combustion in stages, high temperatures can be avoided thereby creating fewer nitrogen compounds.

The combustion of gas yields only a little carbon monoxide in comparison to the combustion of solids. The gas needs to be cleaned and cooled for use in an internal combustion engine. During gasification and in the cooling system, a combined total of up to 1.3 kilograms of liquid can result per kilogram of biomass. To this is added 0.1 to 0.3 kilograms of tar.

The condensate is polluted by toxins such as phenols, cresols, cyanides and formaldehydes. The chemical and biological oxygen requirement triggered by these pollutants is many times greater than the limits for community waste water.

#### **Germany: New Heating Compressor Conserves Energy**

95WS0093B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 25 Nov 94 p 8

[Article by "re" under the rubric "Companies/Research/Technology": "Compressor Heat Being Used Twice. Atlas Copco: Waste Heat Recovery Plants Quickly Paying for Themselves"]

[FBIS Translated Text] Frankfurt—The Atlas Copco Kompressoren GmbH [Compressors, Ltd.] company in Essen reports that even with relatively small compressors the installation of a waste heat recovery plant as a rule pays for itself within three years, and even in one and a half years with larger compressors. For example, 20,000 kilowatt-hours can be recovered and be used for heating or for service water heating with a 30-kilowatt compressor that is in operation for around 1000 hours per year. Just under three cubic meters of heating oil can be saved in this way, they say.

A good 75 percent of the electrical energy supplied to the air compressor can be recovered. Nearly 100 percent of the shaft output of a compressor's motor is yielded as waste heat at the compressor's intercooler or aftercooler. It reads further that the drive motor itself also gives off more heat, in addition to the heat generated in the compressor element. Thus a compressor plant produces a total amount of heat equal to 105 to 115 percent of the shaft output.

Operating areas, for example, can be heated without great expense by means of the recovered energy, because the heated air is conducted through ventilating ducts on the spot in the case of air-cooled machines. However, the carrying distances must not be too large here. Surplus hot

air can then, directed by control valves, be conducted into the open air or through a heat exchanger for the purpose of heating water.

Atlas Copco explains that water-cooled compressors, on the other hand, supply, without roundabout routes, 50-to-60°C hot water that can be used directly, if the high cost of fresh water does not contravene this. Here too it is better to go the route through a heat exchanger and conduct the water in a closed cooling circuit.

Waste heat recovery becomes especially easy and also inexpensive to install when an oil-injection screw compressor is used, as is already almost the rule with larger plants. Here the waste heat recovery can be arranged quite easily in the oil circuit. The oil cooler is combined with a heat exchanger for this purpose. Water temperatures of 90°Celsius can easily be attained with this method, they say.

The specific design of the heat exchanger varies according to the operating pressure in bars, the compressor's air intake temperature, the quantity of water expected, the water inlet and outlet temperature and the permissible loss of pressure in the system. Atlas Copco recommends paying attention to the compressor's duty factor, not only for the sake of an as constant as possible usable quantity of heat, but also for the sake of cost recovery.

#### **Germany: Ultrasonic Devices Seen as Boon to Environment**

95WS0102C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 1 Dec 94 p 8

[Article by Christine Hirche and Volker Rosenbaum: "Many Processes can Become More Environmentally Friendly Using Ultrasound. Perspectives of Sonochemistry. Information Day at Dechema]

[FBIS Translated Text] Frankfurt—The application of ultrasound opens interesting perspectives in chemical reaction technology. There have already been successes with this in many areas, even if only in the laboratory for now. More than 70 specialists from industry and colleges discussed the mechanisms and their application perspectives recently at an information day at Dechema, the German Society for Chemical Apparatus, Chemical Technology, and Biotechnology, e. V., in Frankfurt.

Sonochemistry uses sound waves having frequencies ranging from 20 kilohertz to 2 megahertz. The waves produce cavitation bubbles in liquids. These bubbles grow due to the ultrasound up to a maximum radius. At 20 kilohertz, this radius is about 100 micrometers and at 1 megahertz, the radius is 7 micrometers. The following sudden collapse (implosion) creates energy hot spots with temperatures exceeding 5000°C and pressures over 2000 atmospheres. This process was described by Professor Timothy J. Mason, director of the Center of Excellence in Sonochemistry at Coventry University in Great Britain.



When the bubbles implode, a high concentration of radical ions is created, particularly at high frequencies. This opens interesting potentials for radical chemistry. However, thermal and mechanical effects that can affect the chemical reactions also occur. Ultrasound can greatly accelerate heterogenous processes by producing new surfaces and by improving mass transfer and mixing.

In a pilot project currently funded by the Ministry of Future Affairs in Bonn, two German college groups, in cooperation with 12 European partners, are to examine sonochemical effects closer and to test how they can be put to use. The mechanisms for sonolytic decomposition of macromolecules using aqueous dextran solutions is being investigated by a working group under Professor Helmut Heusinger at the Technical University of Munich. Dextrans are gaining increasing industrial significance as blood replacements, among other uses.

At the University of Rostock, the working group of Professor Ralf Miethchen is attempting a non-destructive, direct and selective introduction of fluorine or perfluoroalkyl groups into selected organic compounds with the help of ultrasound.

Three more European joint projects to apply sonochemistry have been initiated since last year by Great Britain. Research groups from eastern Europe, in addition to France, are represented in these projects. The eastern European groups come from Slovakia, Romania, and the former Soviet Union.

If the cavitation does not occur in the liquid but rather near a solid surface, the collapse occurs asymmetrically and the energy is concentrated on the surface. Oxide layers and deposits can be removed in this manner. The surface is activated and mass transfer to the surface is improved considerably. Surfaces pretreated in this manner are well suited to subsequent coatings or impregnations, for example.

Ultrasound can leave its effect even on biological systems, for example, cells. A comprehensive application field of ultrasound is to be expected in biochemical reactions. In this way, the activity of baker's yeast can be multiplied if it is stimulated beforehand by ultrasound. The reason for this is the improved material transfer properties based on local destruction of cell membranes without damaging the contents.

Depending upon the frequency and power of the sound waves, enzymes are either activated or destroyed. In the former case, this is used for peptide synthesis and in the latter case, for the conservation of foodstuffs. In this way, the enzyme activity of lipoxidase, primarily responsible for the degradation process and the spoilage of food, is reduced by the synergy of thermal treatment and ultrasound in as little as 30 seconds to a fraction of that achieved using only thermal treatment.

Even the influence on bacterial growth is enormously increased through the combination of chlorine and ultrasound. The growth of bacteria colonies in water samples

with 1 ppm chlorine content is, for example, depressed after 5 minutes of high-frequency treatment to 10 percent contrasted to samples without the effect of ultrasound.

In environmental technology, trace amounts, say, of phenol, that could be detected in water are converted into harmless carbon dioxide and water. With a combined application of ultrasound and electro-oxidation, the phenol concentration drops from 100 milligrams per liter virtually to zero within 15 minutes.

In metallurgy, ultrasonic treatment makes it possible to produce finer grain spectra and results in improved flow behavior in foundry technology. However, there are advantages in product quality for the welding and cold drawing of pipes. Particularly good expectations exist for electroprocessing, for example, galvanizing technology. Here, ultrasound improves the adhesion, hardness and luster of deposited layers while also increasing deposition rates.

It is suspected that, in addition to surface purity and activation, particularly a greatly improved mass transfer near the surface and possibly even the destruction of the electrochemical double bond play a decisive role.

In medicine, scientists see primarily applications in surgery in the form of an ultrasonic scalpel, in addition to the previously proven applications such as ultrasonic diagnostics and physiotherapy. Originally designed in the United States for plastic surgery, an endoscopic operation was recently performed for the first time in Germany at the Schlosspark Klinik in Berlin. This operation successfully used ultrasound while not destroying tissue.

One advantage ultrasonic cutting possesses over electric scalpels, lasers and cutting using high-pressure water, is lower heat development and the accompanying reduced destruction of adjacent tissue. Ultrasound also is promising for dissolving blood clots. When focused, ultrasound is also capable of destroying cancer tissue or increasing the localized effect of chemotherapy, said Mason quoting the newest research results.

Almost all applications are occurring at this time on a laboratory scale. Further development to larger industrial systems with high sonic powers and frequencies exceeding 500 kilohertz has failed due to a lack of suitable resonance sources and the high requirements placed on power amplifiers. Ultrasound with the required resonance frequencies is generated today using special piezoelectric ceramics.

The power transmitted into a liquid and the shape of the sonic field, however, depend greatly on the incident ultrasonic frequency, the size and shape of the reaction container, and the composition of the liquid. The main problems today are with suitable resonator sources, says Professor Ulrich Hoffmann from the Technical University at Clausthal-Zellerfeld. He also says that new

methods could be used for reactor design, describing the developments currently underway at his institute.

Even the selection of reactor material is not completely without problems. Glass, due to its brittleness, can easily crack. Steel or titanium have better behavior in this respect. However, if the container has weld seams, these also are weak points.

Numerous companies of the chemical industry, the environmental branch and biotechnology are interested in a breakthrough of these new ultrasonic technologies. The working group on sonochemistry was founded on the occasion of the information day at Dechema for this purpose. More than 40 representatives of German industry and colleges participated.

#### **Germany: Quick Test for Ozone Level Developed**

95WS0103A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 2 Dec 94 p 8

[Article by JB: "Quick, Economical Ozone Testing"]

[FBIS Translated Text] The company of Schleicher and Schuell GmbH has developed an economical, quick test for ozone. Concentrations too low to be noticed by smell can allegedly be detected. The detection principle of the test depends on the reaction of potassium iodide and starch with ozone in the surrounding air, as the company reports (P.O. Box 4, 37582 Dassel).

To do the measurement, one drop of potassium iodide solution is placed on a piece of special paper. Within three to four minutes the paper turns color, from pink to dark brown, according to the level of the ozone. The color value is read after one, two and then three minutes and compared with a reference scale. With this test, ozone concentrations from 20 to 2,000 micrograms per cubic meter of air can be measured.

The MAK [maximal allowable concentration in the workplace] value lies within the range of measured values. The stipulated maximum workplace concentration is one part ozone to 10 million parts air (0.1 ppm). This corresponds to a level of 0.2 milligrams of ozone per cubic meter of air. Mucus membrane irritations do not appear until concentrations of 50 to 100 times this are reached. At particularly high concentrations, ozone can also lead to life-threatening pulmonary edema.

Since the test is comparatively simple to do, it is suitable for a broad spectrum of users, as the company reports, and can even be used by private individuals. By doing away with the need for special reagents and special procedures for interpreting results, the test is also quite reasonably priced. One measurement costs about 50 pfennig [or half a mark].

#### **Germany: Increased Mileage, Reduced Emissions Seen as Result of Variable Systems**

95WS0116C Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 5 Dec 94 p 10

[Article: "Fuel Consumption and Exhaust Emissions Are Focus of Development"; subheads: "VDI: Variable Systems Could Still Help Develop Considerable Potential"; "Diesel Engine Has a Future"]

[FBIS Translated Text] Frankfurt—Increased traffic and vehicle density and the environmental problems that go along with it plus soaring fuel prices make improvements in the drive designs in automotive construction imperative. In the future, fuel consumption and exhaust emissions will have to be foremost as a development focus. Variable systems would enable impacting combustion, and in this way considerable potential could be developed in terms of fuel consumption, exhaust emissions, torque gradient and quiet running. Experts pointed this out at the fourteenth joint session of the VDI [Association of German Engineers] Society for Vehicle and Traffic Engineering and Volkswagen Incorporated [AG].

The key to engineering progress is the valve drive. On the periphery of the engine the greatest advances are to be expected in the areas of mixture formation and subsequent handling of the exhaust as well as in engine and drive control. The long-term development goal is also direct injection for the Otto engine that is still undergoing research at present, however.

The regulated three-way catalyzer is the unaltered standard for exhaust design. The denox catalyzer is being worked on intensively throughout the world as an alternative. It would enable engine operation a lean mixture with favorable consumption. Compared to Otto engines, the conventional side-chamber diesel engines consume 15-18 percent less fuel in test operation. In normal vehicle operation, however, there could be up to a 30-percent advantage in consumption and an additional 15 percent in the case of the direct-injection combustion process.

Considering the demand for further reduction of carbon dioxide emissions, development aimed at a direct injector is being pursued. To satisfy future demands, additional devices will be required including multi-valve technology, supercharging with variable turbine geometry, high-pressure injections with freely designable injection flow, electronic engine management, denox catalyzers and particle filters. In the view of experts, all such measures and effects demonstrate that even in the future the diesel engine will constitute a drive system for passenger car drives all the way up to top of the line luxury limousines.

Conventional manual shift transmissions with up to six speeds and automatic four- to five-speed progressive transmissions have realized a high level of technological performance. A further reduction of consumption by 10

percent compared to conventional four-speed automatic transmissions is feasible using infinitely variable gears that soon might be offered not only for compact but also for mid-range cars.

Since the introduction of electronics in motor vehicles, the number of electronically-controlled partial systems even in the drive train have steadily increased and presently includes functions for engine control, gear control, antilock braking system (ABS), control of transmission slippage and vehicle stability, control of vehicle speed and electronic throttle control. Partial systems that have until now been mostly autonomous would be linked via bus systems with fast data transmission.

One possible solution mentioned at the meeting for a perceptible amelioration of inner city emission problems might be electric drive in the streetcar. The vehicle performance and range of an electrically driven vehicle, however, is limited primarily by the capability of the battery. The hybrid drive melds two energy converters and two energy storage units. Combustion and electric engines are combined. Liquid fuel and the traction battery serve as energy storage units.

With an appropriate design, therefore, the advantages of the combustion engine could be combined with those of the electric drive. As in the case of the purely electric vehicle, automotive experts project that the hybrid vehicle too will only penetrate the market if such a concept is desired in terms of energy and environmental policy.

#### **Germany: Increase of Photovoltaic Energy Percentage Advocated**

95P60075A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 22 Dec 94 p 8

[FBIS translated text] Since the efficiency of photovoltaic devices is only about 10 percent, various methods of increasing this efficiency are being sought. Scientists at the University of Essen (Power Supply and Energy Science Area, Professor Dr.-Eng. Rudolf Pruschek, 45117 Essen) have increased the efficiency by up to 30 Percent using a slaved two-axis photovoltaic device. They developed a solar-controlled device with V-shaped concentrators. When determining the shape of the photovoltaic device, a special attempt was made to achieve mechanical stability against wind load stressing. The drive and control systems were designed in such a way that electrical consumption is minimal. The device offers a maximum output of 212 watts. Its aluminum foil concentrators, shown in the picture (not given), have a geometric concentration ratio of 1.48. To achieve an optimum sunlight concentration, the angular deviation between the sun and the solar generator surfaces is limited to less than 5 degrees, the Essen researchers say. A computer that continuously recomputes the sun's position ensures the best energy use. The development is part of the research in the solar working group of

North Rhein-Westphalen, which is working on the conversion of solar energy to usable thermal or electric power.

#### **UK: British Consortium Hopes to Develop Wind Turbines as Alternative Power Source**

95WS0124A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 9 Dec 94 p 8

[Article: "Sea-Based Wind Energy Systems"; subhead: "British Consortium Eager to Develop Appropriate Turbines"]

[FBIS Translated Text] London—Against the background of steady complaints from the public about wind energy systems, a consortium of firms, headed up by Tecnomare of London, has crafted a design for sea-based wind farms. The first stage of the three-stage research project included the building of a small wind turbine and the installation at Teddington (Middlesex) of a test tank three meters in height above the surface of the sea. That called for investments totaling 750,000 pounds, with the Ministry of Trade and Industry sharing in half of it.

In the second stage of the project now, an offshore prototype of the turbine is to be developed and be mounted on a floatable tower. This is to have a hollow concrete base that firmly anchored polyester ropes will maintain so stable that it will be able safely to withstand even the development of hurricane-force gales. It is provided with a rotor that turns like a weather vane in the respective direction of the wind so that its carbon-fiber reinforced plastic blades are constantly exposed to the full force of the wind.

The offshore prototype was designed for an output of approximately 0.5 megawatts. The final turbine, however, is to realize an output of 1.4 megawatts. In keeping with the plans, it is to be equipped with three blades 30 meters in length and set up 45 meters above sea level. The energy that is generated courses through an underwater power-mains cable to the terminus on land and is subsequently stored in Great Britain's domestic power-supply grid.

Although this prototype meets expectations, the third stage of the project will be able to commence with the design of a turbine for serial production. As early as the second stage, however, the consortium will have to contend with financing problems for the nearly two to three million pounds' investment that will be required. Since British ministry support funding apparently will cease, the developers are now hoping for financial support from the European Union.

As early as 1991, Great Britain had launched a program to replace fossil fuels. Since that time about two dozen wind farms have been set up but they quickly encountered occasional stiff-necked resistance from the public. Besides "ruining the landscape," as many claim, the noise that was generated was perceived to be a nuisance. There also appear to be problems with television reception in the vicinity of such wind farms. In turn, the initiators promise fewer problems from sea-based wind energy systems.



**France: Moulinex' Latest Rapid Prototyping Robot Presented**

95WS0098C Paris L'USINE NOUVELLE in French  
1 Dec 94 p 62

[Article by Pascale Leroy-Paulay: "Laser Sintering of Small Production Series With Rapid Prototyping"]

[FBIS Translated Text] It is now possible to obtain functioning parts with rapid prototyping. What has been only a distant dream for many manufacturers is now becoming a reality.

"Ideally, one should be able to build several hundred finished appliances, however innovative they may be, and test them in department stores without first running the financial risk of mass-producing them," suggests Vital Parise, technical director at the Moulinex research center. But to launch an ultramodern robot without first conducting traditional market surveys, one would need inexpensive prototype molds to fabricate the plastic components.

This dream, long entertained by manufacturers of mass-market consumer goods, was still thought impossible only a few years ago. The rapid prototyping machines that came out about a decade ago could not make acrylic resin parts without a lot of fancy engineering footwork. But this utopia is about to become a reality.

Today, machines are working with increasingly varied and resistant materials. The technique of powder sintering with carbon dioxide or YAG laser permits fabrication of plastic parts rigid enough to be functional.

**Goodbye Lost Wax**

The process consists of using a laser beam to sinter a thermofusible powder layer by layer at precise points specified by the CAD [computer-assisted design software] model. The laser can be applied to polyamides, polycarbonate, polystyrene, and wax. Developed by Professor Joseph J. Beaman of the University of Austin, Texas, it is being commercialized by the U.S. company DTM. It is only one more step for software to generate computer instructions that can be used to produce the finished part, bypassing the former need for a lost-wax model. And this has almost been realized. Beaman is already doing tests on injection molds and expects to move on to industrialization of the process next year.

Meanwhile Germany's EOS (Electro Optical System), another company at work on laser sintering, has announced it will offer a machine that can create copper-alloy molds. It has been developed in collaboration with the Electrolux group by adapting an earlier polymer-powder laser sintering machine. "The mold we obtain is 80 percent as dense as a foundry-produced one. It can support as many as 1,000 injections, if the mold joint is fairly simple and material easy to inject," says Michel Cabrera, general manager of EOS France.

Beaman wants to go even further. He envisages using selective powder sintering in facial surgery. After an accident, he would recreate the precise shape of a damaged bone, a jawbone for example, by symmetrically duplicating the undamaged parts. "Then all that remains is to find a sinterable material with the same porosity as the bone and physiologically compatible with it," Beaman explains.

**Cost Barrier**

Clearly, rapid prototyping equipment is advancing very rapidly. But users should keep a few sobering thoughts in mind. Converting the CAD data is still a delicate operation and can misfire, creating parts that don't fit together well. Even a slight shrinkage of materials while parts are solidifying can leave them misshapen.

A final obstacle: cost. Rapid prototyping equipment often requires investments in excess of 1 million francs [Fr]. Until the machines prove they can produce fully operational parts or molds, the cost is too high for a lone enterprise to support. Thus we are seeing a proliferation of service companies that buy the machine and lease it to manufacturers or produce prototypes for them. The Technology Transfer Center in Le Mans, for example, has invested in the DTM process with ten or so manufacturers. "We want to perform endurance tests on complex and fragile parts before mass-producing them," explains Jean Zerbin, director of prototyping at Valeo Electronics, one of the firms participating in the investment.

[box, p 62]

**Promising Tests**

Christophe Bard, head of the office of prototyping at the Chaffoteaux and Maury research center, seems quite pleased with the first operational tests performed on DTM's rapid prototyping equipment. It has been used to fabricate a polyamide model for a hydraulic part that goes into a new model of boiler.

Normally, the original version of the part would be made of glass fiber-reinforced thermosetting plastic. "The part shows very good resistance at 80°C. and 8,000 millibars of pressure. But it will be even more ideal when we can use the final materials," Bard says.[end box]

**German Scientist on IMS Holonic Manufacturing Systems Test Project**

95WS0064A Duesseldorf VDI NACHRICHTEN  
in German 4 Nov 94 p 25

[Article by IFW/KAM: "Holonic Manufacturing Systems Operate Autonomously"; subhead: "The Components Adapt Themselves Automatically to Changing Conditions"]

[FBIS Translated Text] The international research program for manufacturing technology known as Intelligent



*Manufacturing Systems (IMS) has completed its one-year test phase. The feasibility of world-spanning cooperation was tested using six small-scale projects. In doing so, the researchers achieved promising results, especially in "Holonc Manufacturing Systems." Now, they are preparing for a five-year to ten-year large-scale program.*

The background of the IMS programs is simple for Prof. Hans Kurt Tonshoff, director of the Institute for Manufacturing Technology and Metal-Cutting Machine Tools (IFW) of the University of Hannover. "All industrialized countries of the world are currently experiencing very similar challenges due to changes in the social and economic environment and technological obstacles." Within the framework of the worldwide IMS cooperation, the manufacturing technology of the twenty-first century is to be achieved jointly.

Thirty-four partners from Australia, Europe, Japan, Canada and the U.S. participated in the small-scale project entitled Holonic Manufacturing Systems (HMS). Experts all agree that the concept of holonic manufacturing systems offers promising solutions to the requirements placed on manufacturing technology both today and in the future. The systems use results from various scientific areas, for example, biology, psychology, and the social sciences.

The concept is based on the work of Arthur Koestler in modeling biological and social systems. To describe these systems, he coined the term "Holon." This artificial word is a combination of the Greek "holos" (whole) and the suffix "on" that indicates a particle as in proton or neutron. This created word comes from the recognition that a whole or parts exist in an absolute sense neither in biological nor in social systems. The HMS project transfers the principle of the holon to manufacturing technology with the goal of achieving faster and more reliable design and implementation of new or modified machines having an improved ability to scale and expand. In addition to this, high availability is to be achieved by expanded monitoring and diagnostic functions as well as automatic restart or emergency operation in the event of a malfunction. The degree of automation is to be adjustable.

Another goal is an incremental transition from conventional systems to holonic manufacturing systems. These systems adapt quickly and automatically to changes in the production program or volume.

Holons, the elements used to create holonic manufacturing systems, are characterized primarily by autonomy and cooperation. The starting point of HMS views humans explicitly as a part of a holon.

"HMS deviates from the predominant interpretation of the concept of autonomy," emphasizes Dipl.-Ing. Max Winkler. He is the project leader at the Institute for Manufacturing Technology and Metal-Cutting Machine Tools. Instead of "the duration of unmanned operation," autonomy in HMS signifies the ability of a holon to formulate and follow its own plans and strategies. The "lights-out" factory, or 100-percent automation, is expressly not the goal of HMS. The HMS development does not want to replace humans but rather put their specific capabilities, such as flexibility or analysis, to optimal use.

"The process of configuration and cooperation is specified by rules," defines Prof. Tonshoff. The orientation of all holons toward higher-level goals prevents chaotic behavior. This form of organization can be compared to road traffic. The Road Traffic Act provides the framework within which all traffic participants make their individual decisions. "It is fortunate that the rules can be defined such that holons develop somewhat more community spirit than the average driver," emphasized Tonshoff.

The HMS project is characterized by a particularly strong commitment by the industrial partners, says Tonshoff. They have contributed considerably to the content of the European Conference on Holonic Manufacturing Systems. On December 1, 1994, the HMS consortium reported on the current state and the future of holonic manufacturing systems in an all-day conference (organized by the IFW of Hannover). Information may be requested at telephone number 0511-7625092.

The time until the beginning of the large-scale HMS program is being used to define precisely the future research focal points and for the integration of new partners, says Prof. Tonshoff. At this time, intensive discussions and considerations regarding reinforcing the consortium are taking place. The object is to become as established as possible and to check the concepts. Even now, the span of industrial partners extends from food-stuffs producers (Nestle) to steel smelters (TGI, Spain), all the way to electronic controls (Softing).

#### Intelligent Manufacturing Systems (IMS), Test Projects

| Project   | Brief description   | Point of contact   |
|---|---|--|
| Clean Manufacturing in Process Industries       | The goal of this project was to evaluate new technologies needed in process industries to meet the increased environmental requirements in the next five to twenty years. | Abitibi-Price (CDN), ICI Engineering (GB), Finnish Forest Industries Federation (SF), Toyo Engineering (J), Du Pont (U.S.) |
| Concurrent Engineering for Global Manufacturing | In a comparative study, systems and starting points for distributed development services were examined.   | Northern Telecom (CDN), Transfer Technology (GB), North Carolina University (U.S.)   |

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Intelligent Manufacturing Systems (IMS), Test Projects (Continued)

| Project                            | Brief description  | Point of contact  |
|------------------------------------|--|---|
| Globeman 21                        | The goal of this study was the criteria for supporting an efficient "global manufacturing business." Topics included concurrent engineering, inter-enterprise management and enterprise integration. | CSIRO (AUS), University of Toronto (CDN), British Aerospace (GB), Ahlstrom (SF), Toyo Engineering (J) |
| Holonic Manufacturing Systems      | The goal of this project was decentralized manufacturing systems. They consist of modular, autonomous, cooperating and intelligent modules (holons).   | BHP (AUS), Queens University (CDN), Softing GmbH (D), Hitachi (J), Allen-Bradley (U.S.)               |
| Rapid Product Development          | This project investigated and used the technologies and business processes needed for dramatically reducing development cycles.  | Swinburne University (AUS), Pratt & Whitney (CDN), Daimler-Benz (D), UTC (U.S.)                       |
| Gnosis: Systemization of Knowledge | The long-term goal of this project was the development of a starting point for a new paradigm that follows mass production.  | Alberta Research Council (CDN), ADEPA (F), ABB (SF), Mitsubishi Electric (J)                          |

**Photo Captions:**

Each individual holon of a manufacturing system functions automatically and as a part of the whole system.

In the IMS test phase, international consortia worked on the individual projects. Some of them will continue, for example, Holonic manufacturing Systems.

**German Institute Displays Flexible Assembly System**

95WS0064B Duesseldorf VDI NACHRICHTEN  
in German 4 Nov 94 p 23

[Article by KIP: "Assembly Automation from the Set of Building Blocks"; subhead: "Even Small Lot Sizes Can Be Manufactured in a Variable Fashion"]

[FBIS Translated Text] *More and more product versions, smaller and smaller lots—the developers of assembly systems are faced with new challenges. The Institute for Machine Tools and Operational Sciences (IWB) of the Technical University of Munich presented a highly automated solution at Systec. A flexible assembly system was displayed that can be quickly converted to new manufacturing tasks according to the modular principle.*

In Halle 6, Dipl.-Ing. Robert Kuba from the IWB explained the structure of a modular assembly system. "The peripheral components needed for assembly are the workpiece carriers, assembly devices and sensor equipment for monitoring. These are positioned on the product-neutral structure using standardized interfaces." In this way, the cell can be converted to an individual assembly platform in the shortest possible time. The introduction of parts, tools and sequential programs automatically represents the conversion process. Dipl.-Ing. Niklas Fichtmueller from the IWB explains further, "The modularly constructed control technology makes it possible to link up with the higher-level planning and control tier. An important factor is the homogeneous communications infrastructure."

The assembly system presented in Munich consists of an automated high-stacking storage facility, the area for assembly preparation (parts storage and fetching), two automated assembly cells, one semi-automated work station and the testing cell. The individual system components are linked by way of a flexible material flow system with automated conveyor wagons. Due to the standardized design, both parts carriers and assembly devices can be transported on these wagons.

"An additional flexibility aspect of the cell is the centralized monitoring of the assembly process using a flexible laser sensor. This sensor can be utilized in several systems. For example, it is used to check for the presence of components and the quantity of parts in storage facilities," says Robert Kuba. In this way, a peripheral sensing system that is linked to a specific device is not needed and process monitoring applicable to virtually any task can be implemented.

The decentralized control structure facilitates the coordinated introduction and processing of assembly jobs. "The homogeneous data infrastructure, by means of the standardized instruction set MMS, ensures the exchange of information between the system components and with the coordination tier," explains Niklas Fichtmueller.

During the EDV design for the flexible assembly system, care was taken that only essential information was exchanged between the tiers. The administration of individual assembly stations—the cell computer function—is performed by the robot control systems. "This is made possible by event-driven robot programming," says Robert Kuba. In this way, the robot control system is responsible for processing the assembly job by downloading subroutines and, if necessary, by starting the main program. After this, it automatically handles the job. In the course of the assembly process, only status messages, such as the progress of the assembly job, are sent back to the coordinating location via the reading and writing of variables.

### Germany: Flexible Guidance for Automatic Guided Vehicles

95WS0064C Duesseldorf VDI NACHRICHTEN  
in German 4 Nov 94 p 25

[Article by KIP: "Flexible Control System Keeps Transport Vehicles on Course"; subhead: "EDV Accelerates Intra-Plant Material Flow"]

[FBIS Translated Text] The Fraunhofer Institute for Material Flow and Logistics (IML) from Dortmund solicited visitor interest in Munich with a universally applicable, expandable control system for driverless transport systems. The division of the system into two parts was emphasized by the IML expert, Thomas Albrecht. The two parts of the system are "Aufkurs," the stationary job and course computer, and "Mobifast," the mobile vehicle control system. "Both components together form a powerful flexible control system adaptable for every problem."

The path control system, as a part of the stationary "navigation system," determines the shortest distance for the vehicle to the specified destination and generates a complete, directly executable job containing all necessary course data. The corresponding data are transferred by means of infrared or radio data transmission. "Intelligent interface modules are used to connect any number of such transmission devices," says Thomas Albrecht. A block straight-line management system prevents, according to claims by the Institute, both collisions and "deadlocks," i.e., situations where no car may continue its trip without colliding with another car.

Both control systems are based on a VME bus system. A comprehensive diagnostic and servicing module supports start-up of the vehicles. Most parameters can be entered or changed via a terminal. In particular, the peripheral data may be displayed on the terminal. The path and axle control is performed digitally to a large extent by the vehicle computer. Only the speed control of the travel and steering drives uses analog technology.

### Germany: New Applications, Developments in Stereolithography Noted

95WS0118A Duesseldorf VDI-Z in German Nov/Dec 94  
pp 44-49

[Article by Wilfried Koenig, Ivo Celi, Stefan Noeken: "Stereolithography"; Subhead: "Increase in Process Capability and Development Trend Toward Development of New Areas of Application"]

[FBIS Translated Text] Aachen—Rapid prototyping processes such as stereolithography make it possible rapidly to produce complex models, sample parts and prototypes directly on the basis of CAD [computer-aided design] data and without detouring via molds and tools. The common characteristic of such processes is that the workpieces get their shape not by cutting the material—as in the case of cutting production processes—but by adding on material.

Another common feature lies in the fact that the workpiece is created in layered fashion in the actual production process. Complicated shaped components, even including undercuts and cavities, can be created in this manner in any extremely brief time, meaning in a few hours. The article discusses the possibilities and limits of stereolithography, currently the most widespread rapid prototyping procedure. Additionally, the results of development activities to increase process capability and current developments for the development of new areas of application are presented.

#### The Stereolithography Process

In stereolithography the components are created through local, layered precipitation hardening of a liquid photopolymer using a UV [ultraviolet] laser (photopolymerization). To simplify the mathematical reprocessing, the 3D geometry described in the CAD system is first approximated through triangles and converted into a standardized format (STL format) for rapid prototyping processes. Next, a supporting structure is designed that ensures later separation of the part from the support platform as well as support and fastening of the part during the development process.

The STL data for the part and the support structure are next reprocessed in a special computer process that resolves the 3D geometry in individual cross sections of defined depth. This process is called slicing from the English to slice: cut into slices. Typical layer thicknesses total 0.1-0.2 mm. An XY scanner unit is controlled with the data for the individual cutting planes that guide the laser beam over the surface of the resin in accordance with the computed cut surfaces. The part is successively created on a support platform that is located directly under the bath surface at the start of the processing. The three-dimensional geometry of the part emerges from layered precipitation hardening of the photopolymer and subsequent lowering of the support platform.

Post-processing follows upon the actual development process; the support structure has to be removed and the part is cleansed of the adherent photopolymer that has not cured. Next, the part is fully cured in a post-networked cabinet under UV light. A final surface finish may be needed for functional surfaces and/or surfaces having enhanced optical requirements [1 to 3]. The production cycle from manufacture of parts using stereolithography is presented in abbreviated fashion in graphic 1 [not reproduced]; graphic 2 [not reproduced] schematically illustrates the design of a stereolithography system.

#### Applications and Potential

Stereolithography currently finds application in the production of show-and-tell models and sample parts in the development of products in the automotive, electrical engineering, consumer goods and aerospace industry. The rapid availability of models for purposes of verifying design, for implementation of design and ergonomic studies, for analysis of production and assembly capability as well as documentation, presentation and communication resources affords product developers hitherto unsuspected possibilities. Current developments can be translated inside of a few days into preliminary components.

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Besides reducing the time requirement and costs of producing models and sample parts, stereolithography (as well as the other rapid prototyping processes) contributes to a timely assurance and improvement of product quality. Additionally, the operative effects of such processes are of far-reaching strategic significance. Accelerated prototype production makes it feasible to produce more rapidly products that satisfy current market requirements and customer demands. The speedy availability of models and prototypes even in an early stage of development leads to elevated product maturity. On the basis of intensive analysis of the shape and function of the products even in the early development phases, modification costs are minimal and the products are readied to the point of market entry.

The articulated lever from the aerospace industry illustrated in graphic 3 [not reproduced] is a typical example of the application of the stereolithography process. It is representative of many technical products that require the production of models and sample parts because of the complexity of the parts in the context of product development. In the case of the articulated lever the model serves principally for verification of design, analysis of production and assembly capability as well as a communication and argumentation prop in talks with supplier firms. While production of the sample part with conventional methods of model development would have required several weeks, it was possible applying stereolithography for model development time to be reduced to 4.5 h [hours]. That kind of dramatic reduction in production time can be directly translated into equivalent cost and market advantages.

#### Development Requirement

Despite the successes that can be realized even at present using stereolithography, a continuing slight degree of familiarity and limitations in capability, above all, stand in the way of broad industrial application of this new technology. The mechanical and thermal properties of the materials that are used (acrylic and epoxy resins) seldom satisfy the requirements for functional or strength testing. What is more, the currently attainable precisions of size and shape often are not in keeping with industrial requirements [3]. The causes of the size and shape deviations surfacing in the case of stereolithography are contraction of the material during polymerization and the negative slack resulting therefrom. The shrinkage occurring during polymerization of the resin materials totals approximately 2-7 percent in terms of volume and expresses itself in variations in dimensions. Furthermore, curing of a new layer on an already realized layer induces contractions that lead to a bending moment in the plane of contraction. The resulting negative slack of the part (curl) causes variations in shape that are obvious especially on exposed projections and massive component structures.

The variations in size and shape are determined by a multiplicity of actuating variables, especially in terms of

system, process and material parameters. On the basis of empirically increased process knowledge, the impact of process correcting variables on the most crucial quality features such as contraction and negative slack, however, remains virtually an unknown so far. For that reason, not infrequently, a part has to be developed repeatedly so that the actual production times and costs occasionally deviate considerably from the allowed standard. The prerequisite for increased performance in stereolithography is a basic grasp of the effective mechanisms and the connections among the process correcting variables and the operational result of the production of the part. In the process technology division of the Fraunhofer Institute for Production Technology (IPT) studies have been conducted for a year and a half on the indicated problems.

The factors impacting the quality of a stereolithography part are extremely diverse, graphic 4 [not reproduced]. They include preparation of the data, establishment of the system and the process, the development process, the material used and the subsequent post- and final processing. The IPT's current activities are concentrated on the study of the impacts of the software, the machine and the process parameter including the materials aspect.

#### Materials Developments

Photopolymer producers, for instance, the Ciba Geigy, Du Pont, Allied Signal and other firms engage in considerable development activities to improve the accuracies of stereolithographically produced parts. It was possible to chalk the initial successes primarily using epoxy and vinyl resins. In addition to reduced volume shrinkage—2-3 percent for epoxy resins compared with 5-7 percent for acrylates—and the lower curl resulting therefrom, the improved materials properties of the cured material deserve emphasis. The lower polymerization rate and the sustained chemical reaction after exposure, however, do have a negative impact on the production time and long-term stability of a part produced from epoxy resin.

#### Influencing Variables on the Part of the Machine

To detect machine-based impacts, the STEREOS 600-40 stereolithography system available at the IPT undertook a penetrating study in terms of quality of the beam source, beam guidance system plus precision of the platform drive. Based on experience thus far, the operation result in terms of the system is particularly impacted by the quality and stability of the beam source, the optical properties of the beam guidance system, the reaction rate and quality of the control of the acousto-optical modulator, the quality of the calibration and the control software plus as a result of the dynamic properties of the scanner unit. Furthermore, the position precision of the pulse motor as well as the precision of the guidance tracks of the Z-platform drive and that of the recoating system, that is, of the mixer for coating of the material, have a major impact. In summary, it may be determined from studies on machine-based actuating



variables that with optimum calibration of the scanner, positioning variations in the XY-plane totaling plus or minus 0.05 mm can be realized in so far as the contour is scanned with speeds of less than 2,000 mm/s. In the Z axis it is possible with correct adjustment of the recoating for maximum deviations also of approximately plus or minus 0.05 mm to be realized. To guarantee proper functioning, the beam guidance system especially requires regular control and adjustment because of the long optical paths.

#### Process-based Influencing Variables

In the production of stereolithography parts, the operational result may be impacted in broad limits by the choice of material and process parameters adapted to the productive geometry. Because of the large number of effective parameters and the dependency of the geometry it does not seem to be useful determining the impact of process correcting variables on the operational result for a complex part. An appropriate abstraction of the workpieces via simple experimental workpieces down to individual layers or lines furnishes improved possibilities for studying process parameters. As the complexity of the problem and the number of parameters declines with increasing abstraction, isolated analysis of individual correcting variables becomes feasible and this facilitates a more certain cause/effect correlation.

Process-based influencing variables in the form of scan line include laser output  $P_0$ , scan rate  $v_s$  and distribution of intensity that as a rule only comes into play through input of the laser beam radius  $r_0$ . The validity of the equations for linear depth  $c_d$  and linear breadth  $c_w$  resulting from the Beer-Lambert law of adsorption and the assumption of a normal distribution for the beam profile could be confirmed through experimentation, graphic 5 [not reproduced]. Other variables entering into the equations are the single-beam depth  $d_0$  and the critical energy density  $E_c$ ; those are materials constants that are determined via experimentation and that can be used for predicting the linear profile for specific adjustments of laser output, scan rate and laser beam radius [2]. Those values, however, are heavily position-dependent since the beam profile occasionally diverges extremely depending on the initial position in the bath and is different for various scan axes. It is also to be noted that as output increases, the raw beam and therefore the focal diameter may increase. The variation in their width has to be taken into account subsequently in assessing the results and also in deriving the appropriate measures for process optimization.

The cause of the individual layers' variations in size and shape is the contraction surfacing in polymerization and the process heat, graphic 6 [not reproduced]. The contraction of the resin during curing induces shrinkages that lead to negative slack and inaccuracies of size in a single layer. Contrary to the expectation that a positive vertical negative slack would be adjusted as a consequence of higher polymerization on the laser-side surface

of the layer, the heat created in the course of the reaction leads to a downward curvature of the individual layer. The horizontal negative layer of the layer becomes noticeable as a result of a bulge perpendicular to the scan axis. In the scan axis the contraction declines as the number of exposed lines increases as a result of increasingly effective support.

The Z-axis negative slack of the layer depends primarily on the magnitude of the hatch interval and the scan rate. As the hatch interval increases, that is, the interval of the separate scan lines, and the scan rate increases, the negative slack can be reduced. A low energy input is also advantageous; in fact, a high energy input does enable realization of a sizable thickness of the layer, that renders the layer indifferent to vertical negative slack, but such an apparent advantage has to be paid for with a strong horizontal negative slack. In addition to this there is the other drawback of lower scan rate and as a consequence lengthy development time and sizable over-cure that leads, especially on parts with projections, to defects in size and shape.

T-shaped (cantilever) experimental solids and panels are used as test-piece geometries. Because of their geometric design, the t-shaped solids facilitate acquisition of curl only in a lengthwise direction. With the panels, in turn, that are supported only in the center of a pedestal, a multi-axis state of stress emerges that leads to a three-dimensional negative slack and as a result also facilitates a detailed analysis of exposure techniques. The studies have to be strictly systematic but in terms of the preparation for the experiment as well as cleanup and assessment. The assessment is done by means of microscopy, image processing and optoelectronic digitized systems.

#### Exposure Techniques and Strategies

If layers are exposed along only a single axis, contractions emerge predominantly in the scan axis, and this causes a one-sided warping of the part. Alternating exposure of the layers leads to a more homogeneous development of residual stresses in the part and to an increased stability of the part. Negative slack can be only partly reduced through an appropriate support structure. Correcting the contraction by scaling the geometry of the part only partially produces the desired result in the case of complex geometries since, depending on the rigidity of the layers already produced—especially in transitions from thin-walled to massive structures—the shrinkage is highly pronounced in a different manner.

Double exposure, that is, exposing the layer twice, is available for reducing shrinkages. In the initial exposure, the layer is not yet to have any firm contact with the underlying layer, so that it can contract virtually in isolation. The second exposure process then should bring about the setting. The requirement for realizing the desired effect is precise adjustment of the process parameters to the required thickness of the layer. In doing so it should be taken into account that, first, the layer should

have as little contact as possible with the underlying layer and, second, that if there is too little energy density sufficient shrinkage will not longer occur.

The cell technique has proven to be a highly effective means of reducing curl. The gaps between the cells result in an interruption of the energy flow and therefore a dramatic reduction in warping. One drawback to this technique is the residue of uncured material in the part that may ooze out and negatively impact the long-term stability of the part in subsequent curing. Using the cell technique is problematical for production of thin-walled parts. Solid contact has to be guaranteed among the cells to avoid damaging the parts when removing them from the system. One other, not insignificant drawback to the cell technique is the rather long development time. Development of the cells and their contacts requires at least one double exposure of the part's surfaces and this detracts from productivity.

Using the alternate patch scanning technique (staggered cells technique), an experiment was undertaken to interrupt the energy flow by interrupting the layers and to realize improved stability of the part by staggering the joining. It is also an advantage that the contacts among the cells can be produced relatively weakly reducing exposure time. If the joining is staggered between each layer, a more sizable negative slack is detectable, compared with the cell technique. Already in the process, however, the material is virtually fully cured and this improves the long-term stability.

Other alternatives for reducing negative slack of the part result from targeted influencing of the exposure path. Unlike the exposure techniques that only represent a sample for exposure, a scan strategy modifies the cycle whereby the corresponding sample is introduced. Simple scan strategies, for instance, aim at periodically alternating the starting point of the exposure, to expand projecting areas of preceding layers or to manipulate the sequence in realizing the exposure lines. Other strategies allow for exposing larger surfaces from inside to outside or subdividing them into segments that are cured separately from one another.

#### Developing Possible New Applications

The capability of the stereolithography process coupled with size and shape precisions currently restrict the limited materials properties. Analyses of parts function and stability are only feasible to a limited extent since the properties of polymer materials as a rule are not appropriate to the properties of series materials. In the manufacture of plastic parts or components, combining stereolithography with casting-practice subsequent processing such as plastic vacuum casting may yield a remedy. On the basis of a stereolithography master form such a combined process facilitates production of near-series plastic parts in a rather sizable piece number.

Further prospects have recently emerged too for the production of metallic prototypes and individual parts.

As graphic 7 [not reproduced] illustrates, the IPT, in cooperation with the RWTH [Rhine-Westphalian Institute of Technology], Aachen, Casting Institute, has successfully used parts produced (without the use of special software tools and materials) in the conventional stereolithography process as disposable patterns for the lost-wax process in order to facilitate rapid and cost-effective production of metallic parts. This also basically yields the possibility of developing new areas of application and market segments for the casting sector that until now have been covered by cutting production.

Further applications may be expected in the future for tool and mold production (rapid tooling). Methods are currently being formulated for the rapid and cost-effective production of tools and molds—directly by means of rapid prototyping processes, as illustrated in graphic seven, indirectly by means of rapid prototyping models and downstream coating or shaping processes. Some applications already successfully implemented, for instance, include production of injection-molded tools for the manufacture of lost-wax master forms via the shaping of stereolithography patterns in epoxy resin, production of hand molds for sand casting through the shaping of stereolithography patterns in epoxy resin or the direct production of core boxes for shooting of sand cores using stereolithography.

#### Summary and Outlook

Besides the slight level of familiarity and absent or inadequate transparency of the time and cost savings that can be realized, current obstacles to a broad industrial application of the stereolithography process include the lack of series proximity in the materials that can be processed and inadequate size and shape precisions of the parts. Whereas the existing lack of information in firms regarding the process' potential can be remedied over the short term, there still remains considerable technological development potential in terms of process capability.

It would have been possible, for example, through improvements in computer soft- and hardware as well as in the scanner systems for development times continually to have been shortened over past years, directly impacting parts production costs. Epoxy-resin systems based materials developments promise an improvement of mechanical parts properties plus, via a reduction of volume shrinkage, improved parts qualities. Other significant increases in size and shape precision of the part plus enhanced process safety and economicalness can also be realized by means of a systematic analysis of machine-based actuating variables as well as the impact of numerous processing parameters and process control strategies on the operational result as well as their optimization.

On the basis of improved quality of stereolithographically produced parts, interesting prospects emerge for the manufacture of metal parts via lost-wax casting as well as

for tool and mold development requiring size and shape flaws of absolutely less than plus or minus 0.1 mm. In the future, therefore, additional areas of application will open up so that stereolithography will increasingly complement conventional mold and pattern development.

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#### Germany: New Extruder Concepts Promise Higher Precision in Injection Molded Parts

95WS0116B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 7 Dec 94 p 8

[Article: "Using New Extruder Designs for Increased Precision in Micro-Injection-Molded Parts"; subhead: "Miniature Shots Could Be Better Controlled Using Longer Material Flow Paths"]

[FBIS Translated Text] Aachen—Increasing demand for mini- and micro-components made of plastic is placing high demands on the precision of processing machinery. The shot, above all, is becoming a problem in the

injection molding of micro-precision parts in tiny lot sizes. Including sprue system, it is on the order of one gram or less.

If there is no desire to work with multiple tools or accept a loss of material in the form of unnecessarily large sprues, the issue of extremely small shots arises along with an appropriately controllable repetitive precision for the machine. At the RWTH [Rhine-Westphalian Institute of Technology] in Aachen (professor Dr. Walter Michaeli), the Institute for Plastics Processing is intensively engaged in this problem.

On conventional screw machines, the injection process that is difficult to control particularly constitutes a problem, since the path for the injection of micro-parts often totals only a few millimeters. For reasons of stability, it has been possible so far to reduce the screw diameter to only 14 millimeters.

But the scientists in Aachen argue that the injection process could be better controlled if the path of the material is lengthened. That could be realized using a variety of machine designs.

If flexible use is to be made of an injection molding machine, there must be assurance that even normal granular crystals having a diameter of approximately three to 3.5 millimeters are taken in by the screw. But this means that the remaining residual cross-section of the screw in the granulate intake zone is disproportionately weakened in the case of a small diameter.

If the screw diameter is reduced below 14 millimeters, only special dusts or powders could still be processed. A minimum dwell time plus a longer injection path can be realized using a mere reciprocating engine, since, because of the absence of torsion stress, a very small piston diameter can be selected. With this design it is not possible for the liquefied material, however, to be homogenized either thermally or mechanically which is an indispensable requirement, however, for further processing of various engineering thermoplasts.

A combination of screw preplasticizing and piston injection melds the advantages of both designs. Using a slender piston it is possible to realize even small shot with a long injection path. Simultaneously, screw preplasticizing provides a good processing of the liquefied material. In this system it is possible for a larger screw diameter to be selected resulting in adequate security against malfunctions. A minimal dwell time can be realized through shortening of the screw.

In the meantime, different concepts have been pursued and tested for the design for applying piston injection for small shot. Weak points in the original machine design led to the design of a new micro-precision machine that is presently undergoing testing in the Institute for Plastics Processing in Aachen.

The machine was perfected in cooperation with a machine manufacturer. In the process, special value was



put on improving its assembly capability. In addition, work was performed on shortening the flow path between piston and extruder die. Temperature control was improved and the screw was optimized. The 45-degree configuration between piston injection and screw preplasticizing was maintained for shortening of the flow path, although the components were exchanged with one another.

With this arrangement, the melt channel can be extremely shortened. In this design the piston plunges all the way into the extruder head. A number of heating elements, working separately from one another, were attached to the injection head to improve temperature control. The temperature can be measured at seven points independent one of the other, with the temperature in the injection piston being of special interest.

A thermal element is incorporated all the way to the tip in the pistons, making it possible accurately to measure the melt temperature. This is feasible, since in that zone the injection pistons are not in any metallic contact with the heated cylinder. At the tip the piston increases the temperature of the liquefied material. Temperature control is still being studied at present in the Institute.

Using a screw design program, the screw was shortened and the screw's dwell time was considerably reduced. The designers claim that the results of the experimentation with this initial machine led to an expectation that such machines could develop a niche for mini- and micro-components.

**Germany: 8-12 Billion Mark Potential Possible by 1996 with Improved Service Robots**

95WS0116A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 8 Dec 94 p 8

[Article: "Service Robots Improve Services"; subheads: "Large Markets Could Emerge in Germany"; "More Research Needed"]

[FBIS Translated Text] Frankfurt—Service robots could innovate numerous services. They could be used as manipulators in medicine, as construction robots and as robots in the local government sector. They would be

just as useful in environmental protection and agriculture as in cleaning of objects and surfaces, in maintenance and inspection as well as safety and courier services. The Fraunhofer Institute for Production Technology and Automation calls attention to this in its study "Service Robots—a Contribution to Innovation in the Service Sector."

Altogether, the Institute studied 84 possible applications for which a market potential in Germany of eight to 12 billion German marks [DM] was envisioned by 1996. By the year 2000, a market volume of DM11-19 billion could develop, and in the next decade it DM17-45 billion might even be realizable. Even at present, more than 800 robots are already being used throughout the world for service tasks. The Fraunhofer bases its forecast, among other things, on the fact that in the future the economic significance of services will soar disproportionately.

Still, service robots would have to be attuned to the respective service tasks. A high percentage of cross-application component parts is required for that. It also means that the levels of autonomy and automation should be the basic design parameters as well as structuring of the environment, nature of the human-machine interaction and adaptability to surroundings, goal coordinates, object sizes and courses of action.

A sizable demand for research is surfacing in this regard, and applied research should be at the center of it in the view of the Fraunhofer Institute (Professor R. D. Schraft, Ph.D. (Engineering), Nobelstr. 12, 70569 Stuttgart / Fax: 0711/970-1399), since new product ideas would have a high impact signaling the acceptance and the spread of service robots. Service-oriented research has to formulate methods and tools for the design of technology-based services.

Research, however, also has to be technology-oriented and provide crossover technologies as well as cross-application of key components. Ultimately, research also has to be dedicated to the practical implementation of its results. In this context, it also has the job of research coordination, information logistics and the promotion of strategic cooperative activities.



**UK: Using Infrared Laser Light to Analyze Materials**

95WS00081B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 23 Nov 94 p 8

[Article by eka: "Materials/Tissue Analysis with Ultrashort Laser Light—Diffuse Backscattering Masked Out—Absorber As Gate"]

[FBIS Translated Text] London. In order to obtain sharper images in materials or tissue testing with infrared light, a research group at Femtosecond Optics Group at the London Imperial College has developed a high-performance laser diode. It is meant to replace the conventional argon ion laser which is considered awkward and tedious to operate and can be used only by specially trained experts.

The new laser diode produces light pulses of a billionth of a second duration. It accomplishes this by means of an absorber placed in the beam path which, with increasing light intensity, reaches the saturation range and thereby abruptly interrupts the emission.

A portion of the extremely short light impulses is diverted before entering the material or tissue and as a reference beam superimposes with the light impulses passing straight through the substance to build a hologram. The laser light which remains distributed in the material or tissue and disrupts the analysis of the data will enter the detector moments later and is not captured in this process.

Crystals of chromium-doped lithium fluoride, strontium fluoride and aluminum fluoride are used in the manufacture of the diodes. They emit infrared light which is tunable to wavelengths of between 800 and 880 nanometers. Scientists calculate that they can even expand the tuning range to 700 to 1,000 nanometers.

Diagnostic equipment outfitted with these semiconductor diode lasers can be built to be compact, light and portable. A low voltage source will do for the power supply. Because of its comparatively low cost, its market price could be around 10,000 [English] pounds; today, used equipment costs about 200,000 pounds. Users are expected to be primarily ophthalmologists and dermatologists.

Testing done with infrared light is also allegedly not dangerous, because it does not cause any ionization. For this reason there would also be no reservations about repeating such testing over short intervals of time in order to follow the results of therapeutic interventions. It is very probable that the femtosecond pulsing laser system will find still other potential uses, such as in industrial research.

**Germany: Development, Applications of Microstructured Holograms**

95WS0089A Stuttgart BILD DER WISSENSCHAFT in German Dec 94 pp 108-109

[Article by Jan Lublinski: "Intelligent Lenses"]

[FBIS Translated Text] A well-known physical effect experiences a renaissance in telecommunications: diffraction of light. With diffractive lens systems, it is possible to adapt light rays to any application.

Light rays do not always propagate in straight lines. When they meet an obstacle, they are deflected according to Huygens' principle. The most well-known example is the Fresnel lens, a transparent plate on which many nested rings are engraved. This onion-like structure diffracts light rays such that they all travel to one focal point. Since a diffractive lens can be easily made, flat and in any size, it is used in slide projectors and in floodlights. What happens when the pattern of such a plate is changed? The light rays no longer converge and the diffractive image changes. Or, one prescribes an arbitrary diffractive image and gets the corresponding two-dimensional lens pattern determined via complex computer calculations.

This approach was taken by a group of physicists associated with Prof. Theo Tschudi at the Technical University in Darmstadt. "Our microstructured components take light apart into small partial waves which are individually modified and are then reassembled," collaborator Jens Hossfeld explains. "We code the optical function and thereby create a new class of optical elements: computer-generated holograms." As with three-dimension image holograms, both amplitude and phase of the light wave are being modified.

TELECOM is the underwriter for Tschudi's research: The telecommunications people hope for new possibilities for switching signals transmitted through glass fibers. While optical signals presently still have to be changed into electrical signals, diffractive elements make purely optical switches possible. Thus they are more compact, less prone to malfunction, and more cost-effective in mass production.

Manufacturing such a hologram microstructure is no longer a problem to current lithographic technology. Physicists coat a calcite substrate with a transparent photo-lacquer and expose it to ultra-violet laser light at selected points. Subsequently, the photo-lacquer can be etched off at these places, and a phase hologram is being formed. Light moves more slowly in regions with photo-lacquer than at free places. Behind the hologram, the desired phase and amplitude image is then formed from the sum of these light rays.

It is one of the easier exercises of these researchers, to calculate and manufacture a hologram which partitions a compact bundle of light rays into many small rays without any significant loss. The small rays propagate, keeping a well-defined distance from each other, and can be transmitted into different glass fibers.

This principle is also applied in laser processing of materials: Rather than setting up several high performance lasers in a manufacturing plant, one laser suffices, the light of which is partitioned by a hologram.

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Diffraction elements which allow adjusting the polarization of light waves are a specialty of the Darmstadt group. The holograms are being made non-transparent for one vibrational direction of light by etching the relief into a birefringent substrate.

Using this technology, Prof. Tschudi and his collaborators have built a polarization multiplexer. This hologram combines two rays, each of which come from a different glass fiber, into one single fiber. Each of the two polarization directions remain intact allowing both signals to proceed independently of each other—thus doubling the data transmission rate.

In order to arrange several holograms in series, the Darmstadt physicists utilize liquid crystals—cigar-shaped molecules having the property of aligning themselves in an electric field. These molecules determine the speed of light penetrating them by their positioning. Aided by a computer, the physicists calculated exactly the positions of the liquid crystal at which the voltage has to be applied in order to produce different phase holograms. Using this technology, they succeeded in switching a light ray back and forth between several glass fibers.

Diffraction optics is useful not only for telecommunications: the Darmstadt physicists also want to participate in the most modern development of laser technology—diode-pumped solid state lasers.

These efficient and miniaturized light sources use rays from a semiconductor in order to stimulate a laser crystal. The laser crystal could work significantly more efficiently, if it were possible to choose an especially favorable geometrical distribution of this pumping ray with the aid of holograms.

Jens Hossfeld presents yet another success: "A colleague from nuclear physics came to me and wanted to know if I can produce a light field which corresponds to the electromagnetic field which seizes particles in accelerators and accelerates them to high velocities." The polarization of such a field vibrates from one central point radially outward in all directions and back again into the center.

Hossfeld established a hologram with which very small particles can be accelerated. Such a particle accelerator is the dream of many physicists: Kilometer-long tunnels would be superfluous because the hologram would fit onto a desk.

#### **German/Russian Joint Venture to Produce Microlenses**

95WS0099A Duesseldorf WIRTSCHAFTSWOCHE  
in German 1 Dec 94 p 116-118

[Article by Wolfgang Kempkens: "Polishing with Electrons. A Russian and a German Use New Technology to Open Up Future Market"]

[FBIS Translated Text] Using a pair of tweezers, Vitaly Lissochenko carefully fished out a tiny piece of glass from the plexiglass case and laid it under the microscope. The fine structures, which are hidden to the unaided eye, become visible. "These are cylindrical lenses," explains the professor, a Russian who last taught at the university in Cherkassy in the Ukraine. More than 100 lenses costing up to 300 German marks [DM] fit on the disk, which is the size of a 35mm slide.

Lissochenko has developed a crucial procedure for producing tiny lenses. To increase their transparency, the blank has to be polished. For this purpose the professor uses an electron beam gun which heats up the surface line by line. A hair-thin layer of glass melts and runs uniformly.

In 1992, Lissochenko and his partner Joachim Hentze founded Limo GmbH in Paderborn. "I provided the money, Vitaly provided the know-how," explains Hentze, who functions as head of sales. At the beginning of 1993, they moved the production site to Werther, a small town in the Teutoburg Forest nature preserve. They had their three electron guns made in the electro-vacuum plant in Naltschik. The three machines cost barely DM100,000. "In Germany they would have cost a couple million." In exchange [for the lower price], they are not very user-friendly. Only the professor and the academic colleague he brought along with him from the Ukraine understand how to use it. Before beginning the polishing process, almost a dozen buttons labeled with cyrillic writing have to be activated. "The elaborate operating procedure is no disadvantage," Hentze says. "After all, in one [operational] pass, we produce products worth a few thousand marks."

The Limo group has already completed work on a few orders. While "the revenue still leaves much to be desired," according to Hentze, he still does not give the impression that he is all that unhappy about it. "We are still in the development stage." In any case, the German-Russian team has snagged a prestigious order. Next year the European Southern Observatory (ESO) will receive 200 quartz glass lenses measuring all of two by two millimeters square. They cost DM300 each. Oddly, they will be used in conjunction with one of the world's largest optical systems: with one of four telescopic mirrors each having a diameter of eight meters which the ESO built in the Chilean Andes. The microlenses feed the starlight captured by the giant mirrors manufactured by Schott into the optical fibers which end in a spectrum analyzer.

The path leading to the high quality microlenses conforming to standards of mass production was long. The Russian professor brought along his polishing technique. But how the tiny blanks could be polished economically was, on the other hand, as much a puzzle to him as to his partner. At first their plan was to use etching. Glass lenses can be formed using a method similar to the one used in the manufacture of microchips, whose structures

are created by means of photolithography: they are covered with a light-sensitive layer, exposed via a patterned mask, developed like a film and finally etched. "The necessary machines would have cost us DM20 million to DM30 million," said Hentze—which was hopeless. A cooperative effort with the former GDR semiconductor plant in Frankfurt an der Oder—the necessary equipment stood there idle—fell through. "They quoted unbelievable prices," Lissochenko still bristles to this day.

The two of them took the matter in hand themselves. They traveled roughly 100,000 kilometers throughout Europe, spoke with experts at universities and in businesses. The upshot: so-called ultrasonic molding. A negative form of the microlenses is made from hard metal. This form, together with the glass disk—from which the small optical elements will be created—lightly pressed over it, is held in front of the head of an ultrasonic generator. Water containing suspended microscopic abrasive particles flows between the form and the glass. Agitated by the [ultra]sonic oscillations, the small particles work like polishing machines. In the vacuum chamber of the electron beam gun, the surface becomes smooth and polished before the individual lenses are separated with a delicate band-saw. "Our technique is unique," according to Lissochenko.

"We anticipate a gigantic demand for microlenses in the future," Hentze says. In ten years he intends to have sales of DM50 million—at, however, a new location. On the agenda for next year is the move to the [high-]tech region in Dortmund, where nine companies and institutes involved with microstructures have already settled.

According to Karl-Heinz Brenner, head of applied optics at the Physics Institute of the University of Erlangen-Nuernberg, an incalculable variety of areas for use is emerging, among which are:

- in endoscopes for internal examinations of patients;
- in telecommunications and the entertainment industry for focusing semiconductor laser beams and their coupling into fiber optic networks;
- in scanners, copiers, printers;
- in CD players.

One area is particularly close to Hentze's heart: the improvement of diode-pumped solid-state lasers. These get the energy they transform into laser beams from light flashes emitted by semiconductor lasers. "If this light were collimated with microlenses, there would be an explosion in performance [capacity]," according to Hentze.

**France: Progress Report on Organic Transistor R&D**

95WS0114B Paris LE MONDE INFORMATIQUE  
in French 25 Nov 94 p 31

[Article by P. B.: "Components of the Future: Organic Transistors for Flexible Screens"]

[FBIS Translated Text] *A French laboratory is progressing in the development of organic transistors. These are the basic element for the realization of flexible and large-sized screens.*

Without replacing silicon, integrated circuits incorporating organic components are likely to find a place in information systems five to ten years from now. Their slowness excludes them from the cores of computers, but their low cost and their flexibility opens new applications for them.

The semiconducting properties of organic materials have been the subject of research for the past 40-odd years, aimed as much at understanding the principles of their operation as at finding applications for them.

To render them usable, the researchers must first of all accelerate their operating cycle. Their current slowness stems mainly from structural defects. These can be reduced by improvement and by mastery of the manufacturing process. Owing to the perseverance of Francis Garnier and his team at the CNRS's [National Scientific Research Center's] Molecular Materials Laboratory, France is gradually developing appropriate techniques. In 1986, contrary to general opinion, Francis Garnier formulated the hypothesis that with materials like conjugated oligomers, control of the structural organization of the molecules in thin films would yield significant gains in performance.

**Very Easy Manufacture**

In 1990, the laboratory succeeded in improving performance by a factor of 1,000, with appropriately synthesized materials. In this way, the equivalent of a frequency of 10 kHz was achieved. This is obviously very distant from the MHz's offered by silicon. To obtain usable products, the laboratory is counting on achieving a further factor of 10. Speeds would then become compatible with those of relatively slow peripherals, like screens.

Paralleling this effort, a British researcher, Richard Friend, at Cambridge, has obtained electroluminescent diodes using other organic materials. Combining this with the French technology would yield entirely organic screens. They could be of large size and be implanted on flexible sheets. In turn, they would provide natural applications to automobile windshields and airplane cockpits, for example, for head-up displays. They could also be used in the visors of helmets.

Furthermore, these organic materials are prepared and conditioned at temperatures on the order of 200 to 300

degrees, a far cry from the 1,200 to 1,500-degree temperatures necessary for the preparation of silicon. They can also be installed by methods closer to traditional printing than to the highly sophisticated processes used by the manufacturers of components.

Although their work has been protected by patents, the French teams are now anxious to progress rapidly, if for no other reason than to not be caught up with by other major countries (Japan, especially, with its Mitsubishi and Matsushita companies) that are currently conducting research in the field, often inspired by French ideas. Users will not find this type of products listed in the catalogs of their suppliers for another five to ten years. But some enterprises could be interested in providing support for them.

**JESSI Specialists Rate European Development of Gigabit-DRAM Chip Good**

95WS0102A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 30 Nov 94 p 8

[Article by K. T.: "The Gigabit DRAM Chip is Just Around the Corner. JESSI Specialists Continue To See Good Chance for Development of Mask Lithography"]

[FBIS Translated Text] Munich—Initial laboratory samples of a one-gigabit DRAM [Dynamic Random-Access Memory] chip, ready for operation and fully documented, could be introduced at the International Solid State Conference this coming spring in San Francisco. By 1996, the limit of optical lithography may be extended into the range of 0.18 micrometers. This was noted by specialists at a conference at the European semiconductor research organization JESSI (Joint European Submicron Silicon Program) in Grenoble.

This refutes prophecies for chip fabrication technology that have been circulating for years. According to these, the optical method of exposing the surface of the silicon wafers in many steps using masks and thus applying the structures in the submillimeter range had reached its end. The even narrower lines would then have to be produced using X-ray lithography or electron-beam etching.

The fast and proven mask exposure method, however, has amazingly always been able to keep up with the reduction in size of the structures. Processes such as phase-shift masking in conjunction with exposure using lasers in the low ultraviolet light range ensure mass production of 64-megabit memories with structures in the 0.5 micrometer range even today.

With the new advances in chip fabrication, the European semiconductor industry has been able to keep up with similar efforts in Japan and the United States. A fine structure, however, is only one of the goals to be achieved. Of equal importance are the production of maximum purity silicon and the further development of production, measurement and test technologies such as



the stepper and the wafer analysis equipment using X-ray fluorescence technology.

Solving the problem of providing the appropriate capacitor for each of the million transistors on the one-gigabit DRAM chip without having to increase the chip area too much is also part of this. Until now, it was always possible to accommodate these tiny capacitors having capacitances in the femtofarad range (10 raised to the minus 15) in trenches on the chip surface or to stack them. However, both methods resulted in complications for the 256-megabit DRAM chip which is currently being developed.

New insulating materials that are difficult to process, such as titanium pentoxide, are needed for the gigabit technology. The Japanese company NEC [Nippon Electric Corporation] runs one of the most important semiconductor research centers in the world. It is experimenting with capacitors that, while possessing the necessary capacitance, exhibit only one half the previously needed geometric size.

It can be assumed that it will be about four years until the European 1-gigabit DRAM chip is available in sample quantities. Then, it will be another two years until series production. However, a prerequisite for all this is that investors can provide the financing for such a factory. The amount needed is estimated by the market research institute Dataquest to be 1.9 billion dollars.

During the conference in Grenoble, Jean Paul Klein was confident. He is responsible at JESSI for the submicrometer technology described here. He sees the limit of optical mask technology at 0.12 micrometers. This would be sufficient even for the next generation of 4-gigabit DRAM chips.

In all this, of course, the market must not be forgotten. The astronomically high development costs for the new factories must be recouped by way of the chip prices. This slows their market introduction in contrast to current chips. At this time, the 16-megabit chip is in series production and available. The 64-megabit chip is only available in sample quantities. The fact is, however, that the 4-megabit chip is still the most favorably priced workhorse. Even the old 1-megabit and the 256-kilobit memories are being produced. This all represents 15 years of memory history side by side, as the newspaper *ELECTRONICS WEEKLY* recently noted aptly.

#### **Germany: Future in Telecommunications Seen As Optimistic**

95WS0051B Leinfelden-Echterdingen *COMPUTER ZEITUNG* in German 3 Nov 94 p 3

[Article by Andreas Beuthner: "Telecommunications Boom Extends to Related Industries—German Electronics Industry Wants to Become a Pacesetter Again"]

[FBIS Translated Text] The European electronics industry has great hopes for the near future. Whether this

renewed optimism can be translated into tangible market results will depend largely on the industry's ability to overcome the drawbacks of its location.

Arno Treptow, chairman of the Association of German Electrical Engineers (VDE) is optimistic about his industry's future. The signals from the private economy and government are favorable, and Europe has again gained a foothold in the market: "We are already leading in many key industries."

The VDE considers telecommunications as one of the main factors of the economic recovery and a driving force behind its industry's growth. These rapidly developing technologies have already produced a wide variety of technical and scientific endeavors and new applications which are promising. As Treptow emphasizes, "What we need now are clear decisions and decisive actions."

At the seventh annual meeting of the VDE in Munich the atmosphere was relaxed. Most of the 1200 participants radiated optimism. The depressed mood in the industry had obviously changed in view of the first signs of an economic upswing, even though prominent industry representatives issued warnings in the opening speeches: "We must be pacesetters," Siemens CEO Heinrich von Pierer admonished his audience; "otherwise, we will come in second."

#### **Germany On Its Way to the Top?**

Nobody draws premature conclusions and predicts a bright future. On the contrary: experienced market experts set their standards high and did not bask prematurely in vague success stories. Because, as they put it, in the global fight for market share second place is not much to brag about. As Siemens CEO von Pierer continued, "There are no silver medals for second place; instead, it means that jobs are in immediate danger."

With this comment, von Pierer was rubbing salt into open wounds and touched on a topic which has been a cause of great concern at the VDE for some time: the number of students in information engineering, mathematics and electrical engineering—areas which used to be considered a sure path to a promising career—is going down. One reason for this trend might be the poor chances of finding a suitable job, but there are other consequences which worry the VDE representatives. Smaller first semester classes mean a narrower knowledge base in the electronics industry which depends on research and development.

However, the VDE had some words of consolation. A recent survey conducted by the Sample Institute and commissioned by the VDE showed that acceptance of technology in the Federal Republic is quite high. Thirty-seven percent of 1300 women and men who were surveyed consider the development of new technologies to be very important. Another 22 percent give technology a

"B" when it comes to technology's ability to ensure social and economic progress.

The new federal states have an even more positive attitude towards technical progress than the states of the old Federal Republic. Whether it is a question of quality of life, jobs or better environmental protection, in all instances East Germans who were surveyed were more strongly in favor of forcing technological developments than their counterparts in the West.

#### Five New States View Technology Favorably

In contrast to the lack of confidence among young people the future developments in important industries such as electronics and microelectronics were viewed quite optimistically. Professor Joerg Eberspaecher at the Technical University Munich drew positive conclusions, even though the structural weaknesses—of which there are many—have not been overcome: "Prospects in Germany and Europe are favorable, all research areas are covered very well."

Representatives of the association pointed with pride to the pioneering work done by their industries. In the field of network development, numerous pilot systems have been installed on the basis of broadband ISDN [Integrated Services Digital Network]. The telecommunications industry in Germany opted for the generally accepted transport and communications principle ATM (Asynchronous Transfer Mode) in time. The often quoted information highway—a top project in the United States with direct support from the White House—has triggered a large number of development activities in Germany as well. As Hans Baur who will be leaving the top management at Siemens assured, "We have the technology to provide information highways."

However, as he pointed out, the greatest obstacle is connecting subscribers to digital exchanges and fiber optic lines which have been installed in many parts of East Germany. The difficulties encountered in the introduction of ISDN connections to replace the conventional analog receptacles show the wide gap between technological possibilities and their actual use. The problems are lack of standards and the slow liberalization and regulation of trade practices.

#### Reforms Entangled in Fighting

While important reform projects have been started, they are still hopelessly entangled in fighting between government, private industry and the increasing weight of large international companies. The monopoly of the postal service will be abolished, but nobody knows when and how. In addition, unsolved questions regarding transfer, control and storage of information in European or worldwide networks slow the introduction of the much quoted multimedia age.

Still, the electronics industry does not come empty handed. Its strong position in telecommunications

extends to related technologies as well. German industry has made major progress not only in digital broadband technology, but also in basic technologies such as microelectronics and optoelectronics. Investments ranging in the billions for a new semiconductor site in Dresden, as well as progress in chip manufacturing, e.g., at Temic in Heilbronn, are no coincidence. Many experts feel that a close cooperation between research institutes and companies has been established which has brought about the synergy effects economic researchers are calling for again and again.

The VDE representatives are also very pleased with mobile communications which advanced rapidly from an exotic application to a widely used alternative and extension to the previous fixed stations. From the very beginning, German industry has been a pacesetter in this growth market.

A visible example of internationally recognized expertise in the field of mobile telecommunications is the European standard GSM (Global System for Mobile Communication). Today, about 1.5 million subscribers make their telephone calls in GSM networks, and the number is growing.

There are more impressive success stories to report. Even if the current emphasis is on communications infrastructure, VDE representatives like to look beyond their star discipline. Energy and automation technologies are growth areas which hand in hand with new prospects in markets having more comprehensive information networks. The combined efforts of microelectronics and medical electronics is currently making great strides, new visualization methods enhance process control and highly sensitive measuring systems improve environmental control.

No wonder that the economic downturn has put a damper on this euphoric mood and warnings are being voiced again. VDE general secretary Friedrich Dankwart Althoff said even before the conference started that "the road to a technology consensus is still long and arduous." The VDE top management clearly stated what is required, and these requirements are also mentioned again and again in smaller discussion groups: a stronger commitment to promising technologies if Germany wants to be counted among the leading countries again.

#### Siemens Demands Innovation Initiatives

Baur from Siemens points out that the European Internal Market is still far from reaching the quality "which we would like to see." Different trade practices conditions and national idiosyncrasies slow down investments and thus the speed with which uniform communications structures can be introduced.

"We need innovation initiatives urgently," says Baur. The technological market dynamics puts industry under great pressure. The lead of the American information and entertainment industries in the field of multimedia

services such as video-on-demand is constantly growing. U.S. companies move approximately one third more capital in order to get video transmission started.

The concern of many experts is understandable since many core areas cannot afford any more major mistakes. After huge disasters, such as the HDTV [High-Definition Television] standard for digital TV, the next steps must be carefully considered. Services (increasingly on-line) and software development are already soft spots. Those who cannot handle data terminals will not be able to find information—spectacular as it may be—in the maze of communication lines. And nobody is willing to pay for this any more.

#### **Germany: Eight-Percent Growth in Semiconductor Industry Expected**

95WS0096A Munich *COMPUTERWOCHE* in German 18 Nov 94 p 2

[Article: "German Semiconductor Industry Grows by Eight Percent in 1994"]

[FBIS Translated Text] Munich—In 1993, German producers of semiconductors have increased their sales to seven billion German marks—almost 20 percent more than in the previous year. In this year, eight to ten percent growth may be seen again. However, not all producers profited equally from this increase—producers of computer chips and of building blocks for communication technology were able to advance above average.

An indicator of this growth was the number of exhibitors at the Munich "Electronica" fair: This year, 2301 companies with 559 partners showed their products. According to Gerd vom Hoevel, the departing leader of the Munich Messegesellschaft [Fair Association], the Electronica will take place again in two-year intervals and will cooperate with the corresponding exhibitions in London and Paris. In 1998, the fair will take place on the new grounds at the former airport of Riem, vom Hoevel prophesied.

The will to cooperate was also reinforced in a discussion between makers of computers and parts producers. The position of weak points today was indicated by a question from the audience: The person wanted to know if it is really the PC-industry which advances technological progress, or if it is rather the semiconductor industry which is investing time, money, and ideas. After this, one after the other demanded more cooperation and partnership: Andreas Barth of Compaq, Henk Bodt of Philips, and Pasquale Pistorio of the French-Italian semiconductor producer SGS-Thomson, as reported by SÜD-DEUTSCHE ZEITUNG. Nobody, however, should

dominate others in this, Pistorio added with a glance at the practices customary in the chip market today.

#### **Germany: Porcelain Enamelled Metal Substrates Process Reported for Electronic Components**

95WS0106B Frankfurt/Main *FRANKFURTER ZEITUNG/BLICK DURCH DIE ZEITUNG* in German 6 Dec 94 p 8

[Article by r.e.: "Email Substrate for Electronic Circuits. Better Heat Control in Grill Plates, Flow Heaters and Machines"]

[FBIS Translated Text] Enamelled metal substrates can serve as carriers for electronic components in thick layer technology. The circuits used in screen printing are burned in a conveyor furnace. Such circuits can be made from conductor lines, resistors and insulators, reports the German Email Zentrum [Enamel Center] eV (Zehlendorfer Str.24, 58097 Hagen).

The carrier material for electronic circuits—described as porcelain enamelled metal substrates (PEMS)—has high mechanical stressability, can dissipate heat well and makes electric and magnetic screening possible.

By coating enamelled sheet steel with comparably large surface resistance paths, it allegedly becomes possible to heat the product specifically and efficiently. If a PTC temperature sensor is then printed near this heating system, a heating system with very specific characteristics is created. The rapid temperature sensors permit the best possible control of even very high power densities, where temperature distribution can be managed as desired by means of the appropriate layout.

Since PEMS can withstand heavy mechanical stress, it can also be part of the construction. One example is grill plates for professional kitchens. The plates can allegedly be laid out to be very thin (3 instead of 15 millimeters). This allows heating times to be reduced by 80 percent. If the heating element is installed over the entire surface, temperature distribution is optimized. For short heating times the grill plates would no longer have to remain turned on all day but rather could just be turned on when needed, which would save energy.

According to reports, very effective flow heaters can also be built with PEMS products. In this instance the tubing is imprinted with PEMS heating elements. Because the power densities are high, the heater can be very compactly built. Integrated sensors improve controllability at the same time.

There are more potential uses in plastics processing. Here, [levels of] temperature are generated precisely where necessary for the production technology.



**Germany: Superfast Optoelectronic Switch Studied**  
95WS0124B Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 15 Dec 94 p 8

[Article: "Superfast Optical Switch"]

[FBIS Translated Text] Frankfurt—Berlin's Heinrich-Hertz Institute has introduced an optoelectronic switch capable of 40-gigahertz switching. The institute explains that may be a world-record value. Such technology additionally offers even the development potential for ultrafast switching at frequencies in excess of 100 gigahertz. In this way a single glass fiber cable could effortlessly transmit the total voice and data traffic on Germany's Telekom system of approximately 75 gigabits per second at present. Technological state of the art right now, however, on glass fiber sections is data rates of only 2.5 gigabits per second.

The indium-phosphide-based 40-gigahertz switch operates on the Mach-Zehnder principle. The light signal being throughput is accompanied by an electrical traveling wave. The two-by-two volume switch consists of two 300-micrometer-long three-decibel directional couplers with a three-millimeter long phase-shift zone located between them. The change in refraction coefficient required for phase angle rotation is induced by an electrical field.

The Heinrich-Hertz Institute for Communications Technology Berlin GmbH (Dr. R. Evers, Einsteinufer 37, 10587 Berlin / Fax: 030-31 002-241) also claims that the switch, first, is suitable for distributing a mixed input signal on two separate optical outputs and, second, as an external modulator for eliminating clocking and frequency instability disturbances in semiconductor lasers.

**Netherlands: Opto-Optical Switch Accelerates Data Transmission Rate**

BR0901141795 Amsterdam TECHNISCH  
WEEKBLAD in Dutch 21 Dec 94 p 1

[Report by Wilbert van der Heijden: "Opto-Optical Switch Accelerates Data Transport"]

[FBIS Translated Text] Enschede—The MESA [Institute for the Development of Microelectronics, Materials Development and Sensors and Actuators] institute has made much progress in the field of opto-optical switches. Thus, high-speed components in fiber-optic cables and computer networks may become a reality.

The most important feature of an opto-optical switch is that light from a source—usually laser light—can be switched via a second light source. This makes it possible to achieve speeds of less than 1 picosecond. By way of comparison, the fastest electronic switch cannot achieve speeds below 100 picoseconds. The opto-optical switch offers tremendous possibilities for computers or fiber-optic cable networks.

However, there is one problem: The right material for the opto-optical switch is not yet available. The materials needed are nonlinear with a refractive index that fluctuates adequately as soon as the light intensity changes. If the refractive index is too low, the switch does not work.

In his recent doctoral research study, Dr. J.B.P. van Schoot, who is attached to the MESA institute in Enschede, seemed to have found a suitable material. He succeeded in developing an adequate opto-optical switch from a polymer supplied by AKZO Nobel. Van Schoot wrote his doctoral thesis on this subject at the University of Twente.

"Large-scale applications cannot be expected yet," says Van Schoot. "The lasers needed are too expensive for that." He believes that the most promising prospects are in applications where large quantities of data have to be transmitted and processed. One example are the components of the backbones of computer networks. Van Schoot predicts positive opportunities for collaboration between industry and the MESA institute.



**Table 1: Community Research in Industrial and Materials Technologies**

| Programme                                 | Total funding (MECU) | Number of Projects |
|---|----------------------|--------------------|
| BRITE (1985-88)                           | 185                  | 215                |
| EURAM (1986-89)                           | 30                   | 91                 |
| BRITE-EURAM<br>(1989-92)                  | 500                  | 380                |
| Raw Materials and Recycling<br>(1990-92)  | 23                   | 69                 |
| BRITE-EURAM II Aeronautics<br>(1990-1994) | 670                  | 454                |
| IMT (1994-1998)                           | 1,707                |                    |

**EU BRITE-EURAM II Program Review****Summary of R&D Areas, Funding**

95WS0108A Luxembourg *EURO ABSTRACTS*  
in English No 32, Oct 94 pp 621-630

[Article entitled: "Achieving Our Potential: A Review of EU Research in Industrial and Materials Technologies"]

[FBIS Transcribed Text] The EU research and technological development (RTD) programmes in the field of industrial and materials technologies (IMT) have undoubtedly made a significant contribution to technological progress and industrial growth in Europe. However, Europe is still lagging behind its main competitors, Japan and the United States, in terms of expenditure in industrial research and development (1.3% of GNP against 2.2% and 1.9% respectively) and in the number of researchers in industrial technology. In the build-up to the Fourth Framework Programme, the need for Europe to increase its research capacity and maximise the industrial return on RTD activities have become ever more prominent in the Commission's plans for its specific research programmes, and not least in its programme for IMT.

The Industrial and Materials Technologies programme, under the Fourth Framework Programme, has the benefit of almost a decade of experience of European-funded research in this field. The BRITE (Basic Research in Industrial Technologies for Europe) programme (1985-88), and the EURAM (European Research on Advanced Materials) programme (1986-89), were among the earliest industry-oriented Community RTD initiatives through which international collaboration was a principal objective.

The first joint programme, BRITE-EURAM (1989-92), combined the work undertaken within the two earlier

programmes. At the same time a new research programme in raw materials and recycling was implemented focusing on areas closely related to those in the main BRITE-EURAM programme. Under the Third Framework Programme (1990-94), BRITE-EURAM II was adopted, covering RTD in all areas of industrial and materials technologies including a specific area of activity in aeronautics. This will be replaced by a new programme in Industrial and Materials Technologies (IMT) under the Fourth Framework Programme (1994-1998). The evolution of programmes in this field is shown in Table 1.

**BRITE-EURAM II**

The BRITE-EURAM II programme aims towards the revitalisation of European manufacturing industry by reinforcing its scientific and technological base. Its main objectives are:

- to increase the competitiveness of European industry in the face of strong international challenges, particularly in strategic sectors of advanced technology;
- to strengthen European economic and social cohesion consistent with the pursuit of scientific and technical excellence.

These objectives are being achieved through the implementation of four lines of action set up under the 1990-94 programme: collaborative research projects, concerted actions, cooperative research, and accompanying measures.

Collaborative research projects comprise industrial and focused fundamental research projects which together account for around 90% of the research budget. Industrial projects are selected on the basis of their conformity with the overall research tasks, the collaboration of at least two independent industrial enterprises, and the provisions for subsequent exploitation of the research

results. The focused fundamental research projects are up-stream of industrial research and therefore industrial endorsement is also an important selection criterion.

**Concerted action projects** aim to coordinate research and development activities which are already underway. Many major technological and materials problems facing European industry can best be solved by working together in a multidisciplinary way at the Community level rather than at the national project level. Concerted actions therefore bring together suppliers, producers, users, and academics to discuss innovative solutions to technological and materials problems of major importance for European industry. In concerted actions, the Commission supports the cost of coordination but not the cost of research itself.

**Cooperative research projects** are supported under a special initiative 'CRAFT', set up under the Third Framework Programme (Box 1). The scheme targets its financial support at groups of small and medium-sized enterprises (SMEs) facing a common industrial or technological research need. CRAFT enables the SMEs to contract out research work to outside organisations such as research centres, universities, or other companies. The proposals for projects are submitted and evaluated in two steps: firstly an outline proposal from at least two SMEs from two Member States, and secondly, provided an expansion award is given, the proposers can submit a final report involving at least four SMEs from two Member States.

[Box, p 623]

#### Box 1: Assisting SMEs

Small businesses are the backbone of the European economy. More than two-thirds of the workforce are employed in companies with between 10 and 500 employees and these enterprises make a major contribution to creating new jobs and industrial activities.

SMEs stand to benefit considerably from EU research and technology funding. Most European SMEs in manufacturing are subcontractors for large companies and as such success increasingly depends on the ability to assimilate and exploit technological progress. As in-house R&D capacities are frequently inadequate, SMEs rely on partnerships with other European industries to share the risks and costs and to develop new markets together. The European Commission has taken several initiatives designed to increase the flow of information to SMEs and facilitate the search for partners. The CRAFT programme and the feasibility awards scheme, implemented under BRITE-EURAM II, aim specifically at increasing SME participation in European RTD activities.

Since its implementation, the CRAFT programme has supported 103 projects involving around 1,400 SMEs by the end of this year. Of those SMEs involved, 50% have had no previous involvement in RTD projects and around 80% have had no experience of European level collaboration. In light of its overall success at increasing SME participation, the initiative will continue under the Fourth

Framework Programme, with an increased budget, and will be emulated under other EU research programmes.

Examples of CRAFT projects include:-

- 'AUTOWIND' an autonomous window cleaner for high buildings developed by French, Belgian and Spanish SMEs. The cleaner comprises a robot suspended from cables and attached to the building by suction pads. Control is from the ground using video;
- An improved manufacturing technique for bone prostheses using titanium coated with organic substances and offering high durability and clinical safety. The project involved five SMEs, four of which are carrying out research activities;
- The elimination of allergy problems caused by metal coming into contact with the skin, a problem faced by jewellery and watch manufacturers. This project was proposed by three SMEs which were later joined by 15 others. Research is being carried out by three organisations in France, Spain and Italy. [end box item]

Accompanying measures comprise the feasibility award scheme for SMEs and specific training actions. The feasibility award scheme aims to help SMEs, in particular in the manufacturing, processing and mining sectors, overcome the financial barriers to participation in industrial research activities with other European industrial partners. The selected projects cover the technical areas of the BRITE-EURAM programme and enable SMEs to develop innovative ideas, thereby demonstrating their abilities to potential partners in future collaborative research projects. Specific training actions provide training for the effective application of new technologies developed and include support for research fellowships and subsidies, specific grants to enable the temporary engagement of research scientists and experts with particular qualifications, and courses and conferences.

Funding for each of these actions lines under BRITE-EURAM II is shown in Table 2.

#### Research Areas

Within BRITE-EURAM II, three principal areas of research have been identified, reflecting industry's strategic and economic interests in the foreseeable future (Table 3).

- **Materials** research aims to improve the performance of both advanced and traditional materials at a cost which permits competitive industrial exploitation over a broad range of applications;
- **Design and Engineering** research aims to improve the capability of industry to design and manufacture products which take account of functionality, cost-effectiveness, quality, reliability and maintainability, and environmental and social acceptability;
- **Aeronautics** research aims to strengthen the technology base of Europe's aeronautical industry.

**Table 2: Funding under BRITE-EURAM 2 by Action Type**

|                                       |     |              |
|---------------------------------------|-----|--------------|
| Industrial research projects          | 77% | (483.8 MECU) |
| Focused fundamental research projects | 10% | (62.8 MECU)  |
| CRAFT Cooperative research            | 9%  | (56.5 MECU)  |
| Concerted Actions                     | 1%  | (6.3 MECU)   |
| Feasibility Awards                    | 1%  | (6.3 MECU)   |
| Specific training actions             | 2%  | (12.6 MECU)  |

**Area I: Raw Materials and Advanced Materials**

The scope of this area of research is very broad, covering the exploration and extraction of raw materials to recycling technologies and the development of new and improved materials and applications.

Research in raw materials seeks to develop new, and improve existing, technologies for the exploration and extraction of mineral deposits. Special attention is being given to the development of techniques and modelling for prospecting mineral deposits, in particular those resources of a complex nature containing basic and strategically important metals. In mining, work is being undertaken to improve drilling technologies for cost-effective prospecting and exploitation and to develop technologies in the field of automation, extracting processes and metallurgical/mineralogical treatment (pyrometallurgical and hydrometallurgical processing). Research into the occupational health hazards and the environmental impacts of the exploitation technologies feature strongly throughout research projects in this field.

As European industry, and its competitors worldwide, move towards a new environmental consciousness, recycling technologies have an ever increasing importance in industrial development strategies. Within Area I of the BRITE-EURAM programme, two key areas of recycling are being addressed: the recycling and recovery of industrial waste including non-ferrous metals, and the recycling, recovery and reuse of advanced materials. The objective of

the former is to develop new technologies for physical and/or chemical treatment of residues, scraps and industrial waste in order to improve the recovery rates and minimise environmental problems. The second area aims to improve recycling technologies seeking to reuse materials waste for advanced materials with a high economic value.

[Box, p 625]

**Box 2. The Mining Microbes**

The use of microorganisms for the extraction of metal ions is not a new phenomena: bacterial activity has been used unknowingly in copper extraction since the eighteenth century in copper mines of south-west Spain. However, the full potential of harnessing microorganisms in mining operations for economic and environmental benefit has only recently been realised.

BRITE-EURAM II has supported a trans-national, industry-university partnership which has set about improving the existing bacterial methods of recuperation and removal of heavy and/or precious metals with a higher concentration rate. The principal task of the project is to construct a model including each parameter which affects the rate and quantity of heavy metal retrieval from different industries. These following parameters have been used in the model:-

- genetic - genetic coding for heavy metal resistance, for metal binding proteins and for siderophore production;

**Table 3: Funding under BRITE-EURAM II by Research Theme**

|                             |            |     |
|-----------------------------|------------|-----|
| Raw Materials and Recycling | 80 MECU    | 12% |
| Advanced Materials          | 228.8 MECU | 35% |
| Design and Manufacturing    | 301.5 MECU | 45% |
| Aeronautics Research        | 53 MECU    | 8%  |

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- biochemical - metal binding proteins, enzyme activity, secondary metabolites;
- cellular - cell change, functional groups polymers;
- micro-environmental - pH gradient, extra-cellular polymers, redox potential, ionic composition and concentrations.

The model should allow researchers to improve the bonding between metals and bacteria to the extent that the process changes from biosorption (5-10% of metal bound per biomass) to one of biomineralisation (more than 50% of metal per biomass). In this way bacterial processes will become useful for heavy metal removal and recovery in different industries. The study will be the first that approaches a problem in a global way using the different capacities of the partners. [end boxed item]

Research in new and improved materials is divided within three main areas: high performance structural materials, advanced functional materials and mass commodity materials. In the field of structural materials, research focuses on metals, ceramics, polymers and their composites, with the objective of achieving a better understanding of the properties and full potential of each material in structural applications. Functional materials research is divided between materials for magnetic, superconducting, optical, electrical and biomaterial applications. Particular emphasis is given to research on new developments or radical innovations in advanced materials for key applications which may also have important spin-off effects in other industrial areas. Research in conventional mass commodity materials covers packaging and new construction industry materials, focusing particularly on production and quality control technologies and to new and improved materials and their applications.

#### Area 2: Design and Manufacturing

The objective of this area of research is to improve the capability of industry to design and manufacture products which are, at the same time, of high quality, easy to maintain, highly competitive and environmentally and socially acceptable. Research focuses on the application of advanced enabling disciplines such as physics and chemistry, mechanics, optics acoustics, fluid dynamics, mathematical modelling and process engineering, and their integration into new technological developments such as optoelectronics (optics, materials, and electronics), mechatronics (mechanical engineering, computing and electronics), microtechnology and micro and nano-structural engineering, including molecular engineering. Special consideration is given to the modernisation of traditional industry through active involvement of SMEs, with their particular know-how and as experimental shop floors.

[Box, p 626]

#### Box 3: The Reusable Microfiche

It has been estimated that 96% of all information now stored in the world is stored on paper. Information

technology systems such as optical discs constitute less than 1% of the total. Between these two types of information storage there are microfiches which are still often used in banks, insurance companies and libraries. The microfiche systems currently on the market come from classic photographic technology, requiring a stage of chemical processing during their production.

A project supported under the BRITE programme promises to bring production of microfiches to an end. The AKZO company and four British partners have come together to develop a new and revolutionary generation of microfiches in which information can be stored and retrieved in an erasable polymeric media. The technology uses several dyed liquid-crystalline polymer (LCP) films which are opaque at ordinary temperatures but turn transparent when warmed up. A beam of infra-red laser light is used to encode information. The recorded image has an expected life of 20 years and can be read through a hand-held viewer or by machine. The developed system is immediately applicable to the micrographics industry, and other analog-image storage areas. The film may also be suitable for digital storage applications, including disks, tape and optical cards. [end boxed item]

[Box, p 626]

#### Box 4: Planning the Future for the European Car Industry

The BRITE-EURAM programme identified a need to address planning and organisational issues within European industry such as how to use human resources to their maximum advantage, and the management of technological change. The automobile industry has taken the opportunity to set up a trans-national, cooperative research project into the development of Future Working Structures (FWS) which addresses the challenges of technological, social and competitive change. The objective of the FWS is to provide the European car industry with a sustainable competitive advantage over its international competitors. This will be achieved by the benchmarking, identification, analysis, development and testing of alternative working structures that will achieve sustainable higher product quality and productivity at lowest economic and social cost.

Current social, technological and competitive changes must be incorporated into the development of FWS in the same way as the work reference framework, which is becoming steadily more comprehensive. In view of these different overall conditions, the following five working packages have been defined:-

- social environment;
- corporate structures;
- supply chain planning process;
- working systems and job design in specified departments;
- final output.

The results of the project will be available both in the form of analytical descriptions, guidelines and databases



for the design of working structures. Project results will also be relevant to companies in other branches of industry. [end boxed item]

Research in design focuses on three aspects of design products and processes: innovative design tools and techniques, design methodologies for complex components, and the development of support tools for improved product performance, maintainability and reliability. In manufacturing, the objectives are to develop tools and techniques for high quality, cost-effective manufacturing systems, to help realise the full potential of advanced materials in manufacturing techniques and to advance the understanding needed to design and control chemical processes in chemical engineering. Lastly, research in this area also focuses on engineering and management strategies for the whole product life-cycle, involving a more integrated approach to product life-cycles, engineering concepts and the human factors in engineering and manufacturing management.

### Area 3: Aeronautics

The objectives of this specific activity within BRITE-EURAM II are threefold: strengthening the technology base of the European aeronautical industry; minimising environmental impact and enhancing the safety and efficiency of aircraft operations; and promoting further cooperation between large high-technology companies, SMEs and research institutions/universities throughout the Community. In meeting these objectives, research focuses on the following six areas of activity:

- **Environment-related technologies** - where research focuses on the reduction of exterior and interior noise and exhaust emissions;
- **Technologies of aircraft operation** - where research aims to develop new or improved tools and techniques for monitoring the health of aircraft systems, designing structures resistant to fatigue, crash and fire, and for integration of the air vehicle in future advanced air traffic control systems;
- **Aerodynamics and aerothermodynamics** - where attention focuses on computational fluid dynamics (CFD), techniques of drag reduction by laminar flow for subsonic and supersonic transport, propulsion integration and the internal aerothermodynamics of turbo-machinery;
- **Aeronautical structures and manufacturing technologies** - where research aims to advance techniques for realisation of large pressurised composite fuselage structures;
- **Avionic system technologies** - where research aims to provide new or improved techniques for design of modular, high integrity airborne information processing and sensing systems for analysis and design of man-machine interaction on the flight deck;

- **Mechanical, utility and actuation technologies** - where research focuses on the optimisation and the exploitation of new technology in aircraft mechanical systems, aircraft utility systems and in aircraft actuation sub-systems.

### A Process of Evaluation

Throughout the BRITE-EURAM programmes and their predecessors, the Commission has paid consistent attention to the process of evaluation as a means to improve the effectiveness of EU support for industrial and materials technologies research (see second article of this issue). The recommendations arising from the evaluation procedure steer the programme into the future, providing a base on which to revise aims and objectives, and the management and implementation procedures. Ineffective and insufficient exploitation of project results has emerged as the principal concern of the past programmes in this field, and in the future measures to improve successful exploitation will be introduced at all stages of project implementation.

### Gaining Momentum

The framework for the IMT programme under the new Framework programme is now well defined. The EU will continue to play a catalytic role in improving European competitiveness. As well as continuing existing activities in this field, the new programme will strengthen research in generic sciences and technologies, broaden the scope of industrial applications and stimulate research in new technologies which have particular global economic impact. The proposed actions cover three main areas:

#### Theme A: Design, engineering, production systems and human management

The objective of this theme is to develop and apply new methods, techniques, processes and tools in each phase of industrial production essential for competitiveness (design and engineering, production and maintenance, quality of products). Particular emphasis will be given to technologies that are favourable to the environment, improve the quality of life and working conditions, and protect the health and safety of workers.

Research will focus on generic solutions for technologies that have strategic significance for the future of European manufacturing industry such as computer integrated technologies (including Computer Integrated Manufacturing and Engineering - CIME), micro-system technologies, man-machine interfaces, lean production/just-in-time manufacturing, the development of rapid prototyping and technologies required for clean manufacturing.

#### Theme B: Materials and material-related technologies (including processing and recycling)

The objective of this theme is twofold: firstly, to improve existing processes commonly used by the material-related industries (mining, metallurgy, chemical processing, construction); and secondly, to ensure the development of traditional and advanced materials which are

ultimately directed towards products. The activities will, to a large extent, follow on from activities undertaken within the Third Framework Programme such as research related to high-performance materials, and improvement in the quality, reliability and performance of materials and products. Research will also cover the recycling and treatment of waste and the recovery of materials at the end of product life, and technologies required for the rational management of primary raw materials and the re-use of secondary materials.

#### **Theme C: Technologies for transport means**

Within this sector research will be expanded from pure aeronautical research to incorporate the automotive, railways and ship building industries. The inclusion of a broader range of transport technologies reflects the growing demand for flexible and efficient transport systems designed and implemented by competitive European firms to meet the needs of increased personal mobility and movement of goods. The objectives of research activities within this field will have to meet stringent requirements laid out in the European transport policy covering comfort, quality, safety, cost efficiency, volume, speed and environmental friendliness of transport means.

Aeronautical research will continue as a sub-programme of the IMT programme, reflecting the high technology requirements of this industry and the potential for technological spin-offs for other industrial or transport sectors.

Although the new programme will continue to focus broadly on the same lines of activity as under the Third Framework Programme, there are some important new developments which reflect the needs of industry. For example, research tasks will predominantly be undertaken through collaborative research projects as before, but greater use will be made of 'thematic networks'. Also the work programme will reflect short, medium and long-term technical objectives rather than a set of specific project definitions. Industry will then be free to define the means by which those objectives are achieved.

Specific activities to stimulate research by and for SMEs (CRAFT and Feasibility Awards, see Box 1) will be improved and reinforced, especially through simplified procedures and the support of decentralized assistance networks. Accompanying measures aimed at strengthening the impact of Community actions will be optimized. These will include: studies, evaluation of impacts, training, support to diffusion and exploitation of RTD results; joint activities with assistance networks for SMEs; measures for decentralized management, and coordination of industrial research on common objectives to facilitate integration of technologies and transfer of knowledge between projects, sectors and other European initiatives, such as EUREKA.

Community efforts in IMT have gathered considerable momentum over the past decade. The evaluation procedure has enabled the Commission to adopt its research programme over time in order to boost the effectiveness and impact of Community action. Together, the increase in financial commitment, the reorientation of research tasks and objectives, and the increased attention given to the exploitation of research results throughout each stage will ensure that the EU continues to play an important role in stimulating innovation and maintaining competitiveness and employment.

#### **Key Publications**

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Industrial and Materials Technologies (BRITE-EURAM II), A Universe of Possibilities..., DGXII/C

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### Exploitation of Program Results

95WS0108B Luxembourg EURO ABSTRACTS  
in English No 32, Oct 94 pp 631-639

[Article prepared for EURO ABSTRACTS by European Service Network, Brussels: "Exploitation Within the BRITE-EURAM Programme"]

[FBIS Transcribed Text] As with its predecessors (BRITE, EURAM, Raw Materials and Recycling, etc.) BRITE-EURAM 2 has always been, by its very nature, highly oriented towards projects that have clear industrial applications. For this reason there are no specific structures, within either the current or future Programmes, dedicated to exploitation. Rather, exploitation has become an integral part of every project:

- Project applications must include an 'exploitation plan' to be considered by the Commission's project officers. Being written before the proposed project has even begun, this document is of course only preliminary in nature. Nevertheless it must show that the partners have already given thought to the market applications of their proposed developments, and to the arrangement for intellectual property rights (IPR).
- This exploitation plan is followed up and expanded on in the project's Mid-Term Review. This is where at least some of the project partners provide concrete ideas as to how the results can be exploited.
- Finally, the partners must produce another exploitation report as part of the Final Report at the end of the project. This confidential report may lead to extra assistance from the VALUE Programme, such as the report's dissemination through the CORDIS database infrastructure and the VALUE Relay Centre network, as well as the possibility of a 'Valorisation project', where funds are made available for market studies, prototyping, and so on.

### Consistent Evaluation

The strong industrial orientation of the IMT programmes has meant that studying their impact on Europe's industrial competitiveness is both highly desirable and feasible. A number of evaluations have therefore been made:

**The BRITE-EURAM/VALUE Evaluation Series:** Each project's Mid-Term Review and Final Report produce a set of indices measuring, for example, the success of the project, its impact upon the partners' technological ability, the efficiency of the collaboration, and so on. These figures have been analysed in an on-going series of evaluations stretching back to 1990. The aim is to draw general conclusions on programme management and make recommendations for future actions.

Carried out by outside consulting firms, these evaluations have between them studied almost 400 BRITE, EURAM and BRITE-EURAM projects completed over the period 1990-1993. This is a unique dataset, being the only systematic study of every finished RTD project for

a given programme anywhere in the world. And as the latter three studies used almost identical reference terms, they clearly demonstrate the evolution of the Programme over time. The end result is a continuous process of improvement as the programmes are made more and more effective.

**The 'BETA Report':** In addition, a separate study, entitled 'The Economic Effects of the BRITE-EURAM Programmes on European Industry' was commissioned in 1992. Referred to here as the 'BETA Report' (after the research team at the Bureau d'Economie Theorique et Appliquee of the University Louis Pasteur, Strasbourg), it presents the direct and indirect economic effects of a statistically-representative group of 50 projects (7 from EURAM, 35 from BRITE and 8 from BRITE-EURAM).

The report's authors conducted extensive face-to-face interviews with all but 3 of these projects' 176 participants. Their aim was to assess the projects' real economic impact per ECU of EC investment, mainly in terms of sales and cost reductions, as generated by the participants for their own benefit. Two types of effects were considered:

- Direct Effects, such as sales of a new product or cost reductions resulting from the project.
- Indirect Effects, including technology transfers and improvements to networking, reputation, internal organisation, training and the firm's knowledge base.

These two reports are complementary: where the first provides an overview of the entire Programme, the second examines a representative sample of these projects in detail.

### Industrial Impact Evaluated

According to these evaluations, how well are BRITE, EURAM and BRITE-EURAM projects being exploited by the partners? There were 7 main conclusions:

- 1) **Success Rate:** Naturally, successful project exploitation requires that the project itself is technically successful. Both evaluations found that at least 70% of the projects achieved their scientific and technological goals.
- 2) **Market Orientation:** The market orientation of a project is a very important factor in its eventual exploitation. The BETA report rated such participant's research in terms of its nearness to the market (see Figure 1), and found that the majority of project participants (almost 40%) are involved in Applied Research, with approximately another 35% working further downstream.

[Box, p 633]

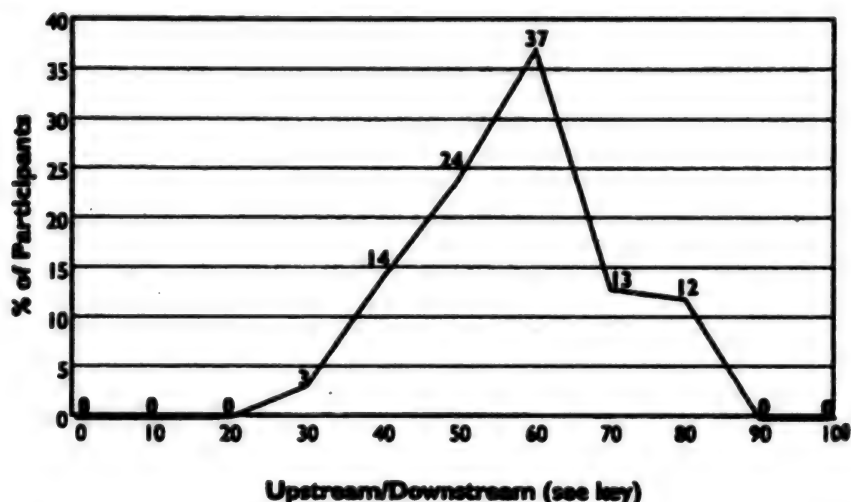
### Box 1: Case Study - Improved Aluminium Recycling (Project MA2R-0001)

#### Recycled vs. Virgin Aluminium

Most people have first-hand experience with aluminium. Its heat conductance has made it an excellent material



Figure 1: Nearness to Market

**Key**

- 100 - Basic Research without any predictable field of industrial application (e.g. how is a star ageing?)
- 80 - Fundamental Research with a possible field of industrial application (e.g. mechanism of a chemical reaction)
- 60 - Applied Research directly devoted to an industrial problem (e.g. modelling a multiphase flow in a chemical reactor)
- 40 - Development (e.g. building a prototype)
- 20 - Process (e.g. improving and using software for design)
- 0 - Quality Control

for kitchen utensils and it is found in most households in this form. It is also used in sectors ranging from the food industry to electronics, furniture and athletic equipment. Aluminium's main drawback is that it is somewhat expensive, both economically and in environmental terms, to produce. The production of virgin aluminium from bauxite ore involves the use of large amounts of electricity. The process is highly technical and, although profitable, its high cost would seem to make recycled aluminium an attractive alternative.

Unfortunately, current recycling technology is relatively primitive. Recycling units are inefficient, often small and cause a relatively high amount of pollution. As aluminium is a metal which readily oxidises, its surfaces typically become coated with a layer of alumina (aluminium oxide) whenever it comes into contact with air. This layer then protects the metal from further oxidation and corrosion. Oxidation is also seen at high temperatures, during smelting, when molten aluminium comes into contact with air. Slag, a solid alumina residue, is formed, capable of trapping up to 65% of the available pure aluminium as it forms around and encases pockets of the molten metal. The resulting substance is known as white dross.

There are some measures which can be taken to help limit losses through white dross, but they represent only

partial solutions. The addition of salts during smelting, for example, can cause a liquefaction of the slag sufficient to allow it to be removed from the furnace or melting pot via an outlet in the base. Current filtration techniques are unable to separate the pure aluminium from the slag, wasting precious resources and making recycling less economically viable.

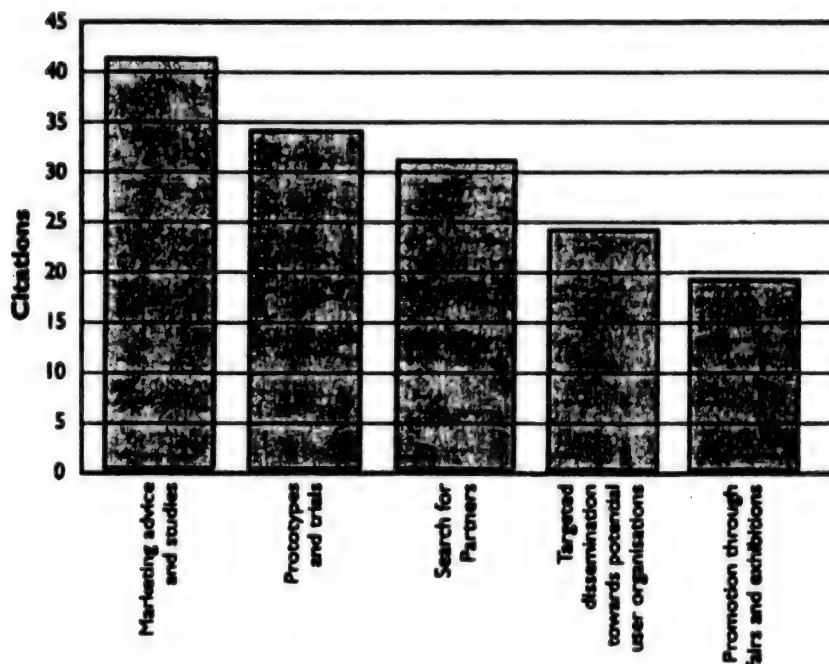
**Setting Higher Goals**

BRITE-EURAM Project MA2R aims to improve upon current recycling techniques, to increase metal-recovery efficiency and simultaneously reduce or eliminate the need for salt.

The first step was to attempt to get a better fundamental understanding of the physical variables at play. Among questions focused on were the behaviour of liquid/solid mixtures and the flow and deformation, or rheology, of salt/oxide/metal mixtures. A dynamic viscometer was initially developed for use in these studies. It met with limited success, but proved to be an ideal separator. Research was subsequently redirected towards separation.

Laboratory recovery tests were carried out using three and ten-litre furnaces. Among the most impressive results were aluminium recovery rates as high as 94% when crushed waste was used, even without adding salt.

Figure 2: Supports to Exploitation



Tests at industrial sites were carried out, altering the operating parameters of existing rotating furnaces and varying the quantity of salt used. The results of these tests were also encouraging. Both lines of inquiry indicated possibilities for significant reductions in salt use.

Other tests were carried out using a tiltable rotating furnace in Spain, looking at a wide range of salt/oxide ratios.

#### Growth Opportunities

The results seem to indicate that an efficient reduced-salt recycling system may be feasible. Such a system might at last enable aluminium to be recycled at a production cost roughly equivalent to that of virgin aluminium, meaning a greatly increased potential market and significant environmental benefits. This project is currently pursuing patents for saltless smelting and for improved smelting through the use of rotating furnaces.

Similar work is currently being carried out abroad, particularly in Canada, so success here in Europe will have significant benefits for European industry. [end boxed item]

3) **Time-to-Market:** The "Time-to-Market" indicates how much more research is required to produce a marketable product from the result of a project, and is thus another good indicator of the industrial orientation of the research

project. The last two BRITE-EURAM/VALUE Evaluations demonstrated conclusively that projects are becoming more industrially oriented. Between 1992 to 1993:

- the percentage of projects with a Time-to-Market of 3 years or less grew from 56% to 73%;
- the percentage of projects with a Time-to-Market of 4-6 years dropped from 35% to 19%.

4) **Exploitation Assistance:** Around half of the projects examined by the 1993 BRITE-EURAM/VALUE Evaluation requested some form of support in exploiting the results of their project. The most popular requests were for marketing advice and studies, followed by prototypes and trials and search for partners (Figure 2). Significantly, 75% of the requested support was made through the EC's VALUE Programme.

[Box p 635]

#### Box 2: Case Study - Cleaner Industrial Cooling Water (Project APAS TPRO-006)

##### Sources of Contamination

Although not commonly seen as an important source of pollution, industrial water-cooling systems are responsible for a large amount of mineral and organic pollution. Dirty, contaminated water is periodically flushed out of cooling systems and often simply released into the nearest river. Cooling system water can come from a

variety of sources. Its composition is generally close to that of "natural" water, with some mineral salts.

In the typical industrial water cooling system, water is pumped as needed from a reservoir through a heat exchanger, emerging in a temperature 10-15 degrees higher than its initial temperature. The water then passes through a cooling tower consisting of a series of fins and baffles. Cooling occurs through evaporation. The water is then returned to the reservoir where the cycle begins again.

The water gradually becomes laden with various types of pollutants during the circulation process, reducing efficiency. The four main sources of this pollution are:

- Salt build-up due to repeated evaporation;
- Microbiological activity in the water, which often increases during circulation;
- Material corrosion which may cause the formation of new contaminants, and;
- Miscellaneous particulate contaminants, including oils or greases which may cause clogging.

To reduce the impact of each of these factors, "cocktails" of chemical products are periodically introduced into cooling systems. They may include precipitation inhibitors, corrosion inhibitors, acids and bases for controlling pH, water softeners, biocides, biodegradants, etc. These cocktails are normally custom-made to suit specific cooling systems. Ironically, these chemical mixtures can themselves become a source of pollution when the water supplies are flushed.

This disposal occurs when the contaminant concentration, and particularly that of mineral salts, becomes excessive. Flushed water typically contains several thousand parts per million of the various pollutants mentioned above.

#### Advanced Membrane Technology

One possible solution to this problem is filtering and reusing the water within the cooling system, using membranes to separate and trap both solid and soluble contaminants contained in the water.

Until now, the use of membranes in water treatment systems has seen limited success, mainly due to the inhospitable conditions typical of industrial cooling systems. Reverse-osmosis cellulose membranes, for example, do not withstand the high temperatures. Composite membranes made of thin polyamide films, on the other hand, are unstable in the presence of chlorine, typically used as a biocide.

Project APAS is attempting to demonstrate improved performance in a new membrane technology. The new technology consists of a reverse osmosis membrane with membrane modules wound into spirals. Originally developed by Separemem under BRITE project P1170, it is both thermostable and chlorine resistant, and should allow a reduction in the discharge of polluted water without affecting the performance of cooling systems.

The project's specific goals are a minimum discharge of 80% of the water initially feeding into the system. This would mean an overall reduction of water consumption of about 30%.

#### Tests Underway

Initial tests will be carried out in the laboratory by varying the composition of water to be treated. The performance of the Separemem membrane will be assessed in terms of discharge, flow rate and fouling. Large-scale tests will then be carried out in an industrial cooling system, the first such tests of membrane technology in the treatment of cooling water within the European Union.

To ensure appropriate maintenance, pre-treatment methodology and cleaning routines will be developed. The efficiency of the Separemem membrane will be compared with similar membranes being produced by other manufacturers. A financial assessment will also be carried out of the treatment of effluent from small (one tonne), medium (1,000 tonne) and large (10,000 tonne) capacity water cooling systems.

Users of the new membrane technology may expect lowered water consumption, lower consumption of chemical treatment products and a reduction in the size of future water treatment units. Although currently there is no demand for membranes in this context, regulations regarding the discharge of flushed water are likely to be tightened in the future. By developing the technology to make complying with such regulations easier, the project is making a positive contribution both to cleaning up the environment and to creating new markets for European companies. [end boxed item]

**5) Exploitation and Project Structure:** What type of collaboration seems to lead to the successful exploitation of results? In investigating this important question, the 1993 BRITE-EURAM/VALUE Evaluation examined the effects on the project's overall performance of having a 'producer' partner—an organisation capable of transforming a technical result into a commercial application—involved in the consortium.

Approximately 76% of the projects studied had producer partners. By making a statistical comparison of their performance with the remainder, the evaluation found that projects with producer partners:

- had a higher capacity for exploitation;
- acquired more know-how;
- were better informed on exploiting their results;
- resulted in greater economic gains;
- can find applications on the market in a shorter time.

The BETA study, on the other hand, looked at the interrelated influence of producer and user groups. The focus here is on the economic benefits for individual participants: if one partner is a producer, the reports asks, does it matter if there is also a user in the project, and vice-versa? The result was clear:

- projects with both Producers and Users generated 10.7 MECU in direct effects and 3.8 MECU in indirect effects per ECU of EC investment;
- The figures for the remaining projects were only 5.4 MECU and 2.2 MECU, respectively.

Hence both studies emphasise that 'vertically integrated' partnerships, where basic research institutes, producers, users and testers work together, are significantly more effective for all concerned.

**6) SMEs and Exploitation:** Both reports recognise that small and medium-sized enterprise (SMEs) face special challenges when participating in EU-sponsored RTD projects. They often lack the resources to:

- evaluate opportunities and technical needs;
- define RTD projects and exploitation plans;
- find RTD partners from other countries;
- study the technical feasibility of an idea before getting involved in an extensive RTD project;
- wait for EC decisions or payments;
- obtain the necessary information on EU Programmes;
- ensure the successful exploitation of the results (protection of results, licensing, market studies, private capital, etc.).

The 1993 BRITE-EURAM/VALUE Evaluation measured the impact of the projects on their SME participants. Eighty-five percent of the SMEs registered a 'medium' or 'strong' impact, a slight improvement over the 1992 study, where the figure was 81%.

The BETA study, on the other hand, compared the effects of the projects on both SMEs and larger firms:

- large partners generated 25.3 MECU in direct effects and 5.45 MECU in indirect effects per ECU of EC investment;
- the SMEs only generated 2 MECU and 2.75 MECU, respectively.

Therefore the BETA report concluded that although SMEs exploit their new membership of a research network to the full and benefit from increased skill levels and training, they often do not have the financial resources to transfer the research result onto the market, making direct effects more difficult to achieve even for technologically successful projects. They also lack a wide spectrum of skills, making the generation of indirect effects through technology transfer difficult.

As in the previous section, the BETA study found that fully-integrated companies are best placed to benefit from the projects. Few companies can be both an SME and fully-integrated. In fact, the only performing SMEs in the industrial sectors covered by the BRITE-EURAM programmes hold a technological and market monopoly in a niche. However, every time this study observed a big firm entering such a niche, the SME lost the ensuing battle.

**7) Assisting SMEs:** As described in the main profile of BRITE-EURAM (see previous article in this issue), there

are a range of initiatives focusing on bringing SMEs into BRITE-EURAM projects and helping them exploit them, including:

- Feasibility Awards, helping SMEs study the feasibility of a research concept and demonstrate their ability as a project partner;
- The CRAFT initiative, designed to help 'low/medium technology' SMEs benefit from advanced RTD.

How have these initiatives, as well as the activities of the VALUE Programme, helped SMEs? Overall, the number of SMEs participating in BRITE-EURAM grew from 18% to 26% between 1988 and 1993. The 1993 BRITE-EURAM/VALUE Evaluation analysed three pilot CRAFT projects, finding that:

- one project, involving a manufacturer and several users, produced results with wider exploitation potential than the other two, which only involved RTD and user participants;
- CRAFT is a positive experience for all, with work continuing between at least some of the partners;
- CRAFT has an impact on training in collaboration at European level and eases further collaborations.

#### **Successful Exploitation: General Conclusions**

In summary, what should project partners do to improve their chances of successfully exploiting their project? The studies show that:

#### **1. Exploitation plans should already be prepared before the end of the project. Partners should:**

- clearly define, at the proposal stage, the forecast industrial objectives;
- seriously consider the consortium and IPR before starting the research;
- set aside some of the budget for regular market-oriented research, technical surveys and the promotion of results;
- use the network of VALUE Relay Centres to diffuse the results and search for partners.

#### **2. Projects should be vertically integrated:**

- include at least one manufacturer;
- involve all types of participants, from basic research labs to end-users;
- avoid having more than one partner with similar skills;
- form partnerships with common strategic and industrial objectives; avoid partnerships designed for the sole purpose of winning EU funds.

#### **3. Project Leaders play a critical role. They:**

- improve the chances of translating technology into products when they come from the manufacturer participant;
- must be trained to look for RTD efficiency and to manage multi-partner, multi-disciplinary and application-oriented research;
- must have sufficient seniority, motivation and resources.



#### 4. As normal project partners, SMEs face special challenges. They should:

- be high-technology in nature;
- work in projects concentrating on their core activities;
- be experienced in international collaboration and markets;
- be of minimum size to exploit the European dimension successfully (e.g., at least 15 personnel);
- not seek a BRITE-EURAM budget of more than 20% of their turnover.

Traditional, low/medium technology SMEs may benefit more from the CRAFT Scheme, especially if the consortia includes partners and manufacturers able to translate research results into further commercial applications.

#### References

The two evaluations referred to in this article are:

- 1993 BRITE-EURAM Evaluation Study - EUR 14541
- Evaluation of BRITE-EURAM Programme - EUR 15070. (The BETA Report is an annex to this document)

In addition, they have been summarised in:

- BRITE-EURAM: A Measurable Impact, EUR 15276 (32 pages, 7 ECU)

Lastly, the main conclusions of the two most recent BRITE-EURAM Evaluations, concerning around 200 projects finished in 1992 and 1993, will be summarised in a new publication in autumn 1994.

#### Europeans Attempt To Streamline EUCLID Program Procedures

95WS0109A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 2 Dec 94 p 48

[Article by Christel Tardif: "Europe Defense Research Proceeding With Difficulty But Assuredly"]

[FBIS Translated Text] *The EUCLID [European Cooperation for the Long Term in Defense] program is currently stuck between the difficult redefinition of each country's defense priorities and procedural unwieldiness. Corrective measures need to be instituted, and they are beginning to take shape.*

Launched four years ago, the EUCLID program of European long-term cooperation in defense research is achieving a certain success. The participating countries have approved 45 projects to date, and contracts with a total value of ECU190 million (1.6 billion francs [Fr]) have been awarded on 25 of these. This success is mitigated, however: "Forty five projects approved in four years is not enough," says Xavier Lebacqz, French coordinator of the program, adding: "Only two new projects were approved in 1992, seven in 1993, and five

this year. That is too few. At least 10 new programs should be being approved every year." Two principal causes can be cited: The unwieldiness of procedures, and the redefinition of defense needs, which many countries still find too nebulous.

These difficulties, already suspected at the outset, were aired openly during the symposium on the EUCLID program, held in The Hague, around the beginning of November. The symposium was attended by 300 to 400 industrialists and government representatives bent on taking stock of cooperative positions and updates. "This rate of participation alone was a success," says Xavier Lebacqz, "and the fact that each and everyone played fair, and made no bones about denouncing what was not working, added to that success."

Granted that the process of redefining the defense priorities of each is not yet stabilized and does not facilitate operation of the tools of this cooperation. But what can be done about it? Insofar as concerns the unwieldiness of procedures, at least, ideas have been gathered for some time now and some are on the verge of implementation. It must be admitted that some aspects of this unwieldiness are not at all surprising given the program's ambitious goal: getting 13 European countries to cooperate in a domain that until now has been considered confidential and hardly receptive to international cooperation. EUCLID suffers from administrative delays that are far too long and from an insufficient number of projects being submitted to the Commission for approval. Some countries take 6 to 9 months to issue a call for bids or to agree on a project.

Last October, the directors of armament approved the creating of a "research" cell in Brussels, within the West European Union. This cell will open its doors next April with an initial "commando" role. A team of seven persons will head the administrative support of each project, providing a sizable participation in the meetings, the preparation of working and official documents, etc. This cell will subsequently be in charge of all EUCLID contracts to ensure uniformity of procedures. A degree of technical competence will then be added to the cell with a view to orienting it toward a role as prime mover behind the defining of each project.

"But that is not enough," says Xavier Lebacqz. Another idea has emerged, namely, that of instituting a system identical to that of EUREKA [European Research Coordination Agency] while hewing to the spirit of EUCLID. This is the EUROFINDER initiative. Currently, EUCLID operates on the basis of calls for bids, proposals, detailed examinations, and award of contract. The idea of EUROFINDER is to incorporate in EUCLID the spontaneous proposals of industrial consortiums, provided the proposal qualifies under a CEPA [Common European Project Area], has the support of the governments involved, and includes self-financing to the extent of at least 50 percent. Specific procedures will

be defined for the processing of these spontaneous proposals. These procedures are expected to be instituted in December of this year.

At the same time, negotiations are under way on a new memorandum of agreement within EUCLID, permitting the state agencies to cooperate without having to create a consortium.

And in what will surely be the final stage toward a perfect European cooperation, "technological niches" will have to be defined, or, in different terms, the areas of technological competency of each one redistributed. The idea is beginning to catch on insofar as concerns test facilities whose utilization and the investment involved are to be nationalized.

#### Photo Caption

View of Bavaria taken by means of Italo-German X-SAR and American SIR-C radars, and reproduced in false colors. The development of satellite onboard SAR's [synthetic aperture radar(s)] is part of one of the 15 CEPA's defined under the EUCLID program.

#### EU Research Ministers Approve Aeronautical, Space Research Under Fourth Framework Program

BR2012143394 Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 9 Dec 94

[Report by Framboisette Jassogne: "New Decisions for The Fourth Framework Program"]

[FBIS Translated Text] On 1 December in Brussels European research ministers adopted 10 or so programs specifically intended to ensure that the fourth framework Community research program is actually implemented as from next year. Two of these programs are of particular interest to the European aeronautical and space industry. These involve specific research and development programs in the transport and environmental sectors, and to a lesser extent specific research and development programs aimed at disseminating and making the most of results, the simulation of training, and the mobility of researchers.

In the transport sector, for which a budget of ECU240 million (1.6 billion French francs [Fr]) has been allocated, the Twelve adopted two approaches.

The first one consists in launching strategic research with a view to establishing a multimodal trans-European transport system, this being an approach to which 20 percent of the total envelope will be allocated. The aim here is "to reach prenormative or prelegislative conclusions enabling us to integrate new policy options into the transport sector." In other words, to ensure that professionals in the sector are motivated to commit themselves to these research projects—tomorrow if they want—in order to influence European transport policy and its technological aspirations.

A second approach consists in doing research that will ensure the optimization of each individual mode of transport. In this context, 16 percent of the available funds will be earmarked for air transport.

The topics dealt with in this transport research program have also been fixed with the help of European experts. Thus, in the air transport sector the Twelve have stuck to three main areas. Firstly, work will focus on air traffic management (ATM). The second area to be dealt with will involve the security aspects of air transport and protection of the environment. Lastly, the third part of the program will ensure that projects to do with airport design, management problems, the different types of traffic in airports, the interface between airport managers and control systems can be maintained.

The specific research program intended to improve the environment should also give a helping hand to the research carried out by the industrial players in the European aeronautical and space sector. The overall budget allocated to this program amounts to ECU532 million (Fr3.5 billion), 47 percent of which is reserved for research aimed at the natural environment and planetary changes, 25 percent for the development of clean technologies, 20.5 percent for space technology for surveillance applications and research on the environment, and 7.5 percent for the study of human aspects.

It is of interest to note the strong entry force into Community research of the space sector. In this respect the Twelve have defined three favorite areas. The first of these involves research into methods for observing the Earth and specific pilot projects, like those on the reliability and profitability of sensors on satellites or aircraft. The second is aimed at the research and development of any further operational activities. The Twelve have already concluded that the existing projects, such as Vegetation, AMAS [Aerospace Medicine Association], and the EURNETSAT projects will benefit from the Community manna via this part of the program. The third area has to do with the implementation of the Earth Observation Center (COT). Europe is prepared to finance a decentralized and coordinated "European Earth observation system."

#### European Industry Urges EU To Increase Information Highway Funding

BR1001090795 Amsterdam COMPUTABLE in Dutch 23 Dec 94 pp 1, 4

[Report signed "MU": "More Funds for Information Highway, Less for Basic Research"]

[FBIS Translated Text] Utrecht—The European Commission should appropriate less funds for basic and applied research into chip technology.

The money becoming available should be used for the development of applications for the electronic superhighway. This view was defended by some of Europe's

biggest software houses, including Cap Gemini Sogeti, SAP, Logica, and Debis Systemhaus.

These companies have associated into the Services Informatics Expertise Advisory Group (SIX). "Our message to the Commission is to 'hurry up.' The prior conditions are met—there is a strong software sector, as well as know-how and expertise to implement applications—and it is time for industry, the EC, and investors to build the information society in Europe," SIX Chairman Pier Paolo Davoli said.

To get things going, the software houses suggested that from the very beginning information highway users should be involved in the development of applications and the boosting of trade relations between customers, suppliers, and investors.

SIX strongly criticized the present functioning of the European Commission's subsidy policy: "The procedure of financing parts of research projects does not result in commercially realistic projects and experiments. As a result, major applications of the information highway are not getting off the ground. In their early stages the projects should get more support from the Commission to create momentum. Afterwards, the private sector will be in a better position to make follow-up investments." The consortium represents 64,000 employees in Europe and has a turnover of over ECU6 billion, i.e., almost 15 billion guilders. In addition to the members already mentioned, the group is made up of Cap Volmac, Data Centralen from Denmark, Sligos and Sema, BMW affiliate Softlab, Finsiel from Italy, and Eritel from Spain. SIX aims to be an independent adviser in matters of European service and software industry policy.

#### **France: Official Position on Ways To Build Information Highways Clarified**

95WS0104B Paris LE MONDE in French 9 Dec 94  
p 13

[Article by C. M.: "Government Opposed to a Sole-Carrier Policy for Implementing of Information Highways"]

[FBIS Translated Text] Should the putting in place of the information highways—the networks over which text, images, and sound are to circulate—be opened to competition? Or, on the contrary, should the approach be that of a concentration of means? Should these arteries be built progressively, making the most of existing facilities—the cable networks, for example? Or should we reckon on taking the technological leap, providing every home with a fiber-optic link?

The debate, foreshadowed by the publication of the Thery report (LE MONDE, 24 October), was engaged more openly during the symposium held at the Defense Ministry on Wednesday 7 December.

Intent on avoiding any appearance of leaning toward dirigisme, the government officials made it a point of

honor, during this discussion, to underscore the "liberal" viewpoint that they felt should govern this vast project. Jose Rossi, the minister of industry, posts and telecommunications, who organized the symposium, expressed the view that the French government's objective is to totally cover the national territory with "infoducs" by year 2015, based on a "voluntaristic" but above all "liberal" industrial approach. In a speech read to the participants, Edouard Balladur, who has catapulted the information highways issue to the level of a "major national ambition," indicated that, in his view, the "infoducs" should not be built "by decree." So much for the statements of principle.

From a practical standpoint, the approach is voluntaristic, in that it is based on encouraging initiatives. It is liberal, in that government officials deem the best stimulant to be the gradual relaxing of regulatory controls.

Simply stated, the government has rejected the model of a sole carrier—in this particular case, France Telecom—responsible for carrying this vast technological undertaking to completion, bearing the burden of its cost, and altogether compensated by a temporary shelter from competition. The government is stating, in effect, that it prefers to bank on a "pragmatic approach based on decentralized initiative." The calls for testing, launched around the end of November, point in that direction.

The government has not taken a position, however, as to relative emphasis to be placed on existing infrastructures, on the one hand, and the creation of new ones, from scratch, on the other. Tests will be conducted in connection with both approaches, said Mr. Rossi, distinguishing between "light" testing, i.e., testing to be done on existing networks, and "heavy" testing, i.e., assuming the creation of "platforms" for the networking of multimedia applications.

#### **"Including the Cable Networks"**

Responding to the arguments of the cable operators, Nicolas Sarkozy, budget minister for communications, expressed the view that "the information highways must include the cable networks." This would mean that, in keeping with the pressures being exerted by the Generale des Eaux [General Water Company] and the Lyonnaise des Eaux [Lyonnaise Water Company], the cable operators could be authorized forthwith to sell telephone services via their infrastructures. Bruno Lasserre, director general of Posts and Telecommunications, who in this capacity heads the regulatory function, partially supported Nicolas Sarkozy's line of reasoning, deeming it "legitimate to permit those desirous of doing so to test, at sites of their choice, the handling of all telecommunications services via cable."

#### **Germany: Experts Critique Technology Subsidy Programs**

95WS0118B Duesseldorf VDI-Z in German Nov/Dec 94  
pp 14-15

[Article: "Technology Centered Support for Research Falls Short"]



[FBIS Translated Text] The training and continuing-education system at the close of the twentieth century is a decisive determinant for mastery of twenty-first-century technologies. Structural innovations lead to radical changes in the technical, personnel and organizational area, that is, they lead to a restructuring of cumulative knowledge. The cumulative knowledge of the past and obsolete qualifications cannot engender innovations. Mere technology support therefore falls short and has to be preceded by preparatory personnel and organizational development programs. Such was the conclusion reached by the panel of experts on "Innovation and the Creation of Knowledge" working for the BMFT's [Federal Research and Technology Ministry] advisory group on "Strategies for Production in the Twenty-First Century." The panel consisted of interdisciplinary experts under the leadership of Prof. Dr. Erich Staudt and notes vulnerabilities in the innovative process as well as provides recommended actions to redirect support for innovation.

In that context it was evident that support in the past limited to technology leads to failures since cultivation of the innovative know-how necessary for economic success is more than the acquisition of technical and scientific knowledge. Because of the lopsidedness, innovations are experimented with in unadapted operational and personnel structures. Since the success of radical changes is limited by the cumulative know-how and the organizational groundwork of the firm undergoing innovation, the development of competencies in the personnel and organizational area have to precede technological innovations.

If the prevailing technologically-centered innovative behavior continues to be reinforced by matching signals from the public sector, for example, through financing of traditional fields of research that sometimes are no longer current, then resources for innovation are scarce. If control of innovation support is also shifted outwards, it then focuses on vogueish trends in the triad and deficits in long-standing industrial structure, leading to foot-dragging and a concentration of support for research in fields that are overstaffed internationally. The expert panel's recommendations for overcoming the incompatibility between that kind of a technologically centered focus and the dynamic requirements of a society undergoing innovation can be summarized as follows:

- Fresh know-how potential has to be developed for the cultivation of knowledge focused on innovation and targeted incentives have to be provided for the development of self-initiated innovative knowledge in fresh directions. This will require non-bureaucratic support for research themes apart from the trend toward a prevalently homogenized support for research influenced by a cartel of experts and those in power.
- The high percentage of public funding tied up in long-standing fields of research deprives a society in need of innovation not only of financial but also

personnel and institutional resources that are not available for fresh themes. Such a distribution of resources that is focused on the current experts and power structures has to be replaced by dynamic competition for research funding. There will have to be a regular review of long-term funding commitments.

- In the case of fundamental innovations, know-how deficits signal that the current practice of separating the development of new technologies and the development of know-how in applied fields has to be done away with. This will call for new forms of personnel and organizational development facilitating organizational learning processes. That is suppressed in support for research limited to technology and continues to be barely perceived in training policy.
- The effectiveness of publicly supported research establishments is moot and is handicapped by the petty pettifoggery of the legalities of governmental budgeting and service. Besides regular assessment of publicly supported research establishments, therefore, there is a pressing need to search for ways of being able to increase their effectiveness and turning them into applied know-how.
- Complex innovative processes are processes involving a division of labor interlinking prior, posterior and lateral areas having specific accumulations of know-how. If any links in this chain are missing, innovation founders or comes about only after much foot-dragging. Innovation requires the cooperative exploitation of shared cumulative know-how. Naive models of technocratic cooperation and information networks that pursue the ideology of freely convertible know-how, however, skirt the issue. Cooperative exploitation of know-how for innovation calls for a change in existing support practices.

The conclusion of the experts is that support for technology will not suffice to warrant Germany as a production hub. Nor is it the new structure and techniques that require continuing education and reengineering of know-how structures, instead it is the potentials and qualifications of the personnel on-site that will lead to new structures.

*The experts' report entitled "Innovation and the Creation of Knowledge—Strategies for Production in the Twenty-First Century" can be obtained from the Institute for Applied Innovative Research (IAI), Bochum, Buscheyplatz 13, 44801 Bochum.*

#### **German Conference Mulls Problems of Innovation, Research**

##### **Call for Cooperation**

95WS0105A Duesseldorf HANDELSBLATT in German 5 Dec 94 p 5

[Article by "bbo": "Research: Villa Huegel Discussion 1994. Innovation Through Cooperation"; first paragraph is an introduction]



[FBIS Translated Text] Essen, Saturday-Sunday, 3-4 Dec 94 (HANDELSBLATT)—German industry's weakness in innovation requires the reorganization of publicly financed research institutions. Proposals for reform were discussed at a discussion among experts held by the Donors Association for German Science.

The organizers set themselves an ambitious goal for their discussion group this year in the historic Villa Hügel in Essen. Experts from industry and science were to discuss the possibilities for "improved innovation capability by the reorganization of publicly financed research." A broad field, as the participants declared unanimously.

The link between German industry's weakness in innovation and publicly financed research was made quickly. The real problem is not a lack of knowledge, but the need to turn this knowledge into products and the too slow pace at which this is being done, as BMW board member Joachim Milberg emphasized again. And here the public research institutions were talked about, whose structures apparently are no longer adequate for doing their share of an innovation process that is becoming ever faster and more cost-intensive.

The time factor was the focus of the discussion. In order to meet the time competition of innovations, industry has had to respond, Milberg emphasized. Decentralization, an interdisciplinary approach, dynamic learning by organizations and the strengthening of accountability and competition are only a few catchwords for how companies have faced the new demands. Daimler-Benz board member Hartmut Weule also emphasized that optimization of the other subsystem—publicly financed research—now has to follow the increased productivity on industry's part.

However, Bonn Professor Bernhard Korte, in asking to speak, cautioned against too much transferring of corporate principles to publicly financed research. The transferring of corporate time management to universities could perhaps even mean the "death of university research." And the president of the German Research Association (DFG), Professor Wolfgang Frühwald, also cautioned against exerting time pressure "when new knowledge is to be gained."

Frühwald, whose organization was favored above all on account of support given to special fields of research, emphasized that it is imperative to maintain the leeway, unique in the world, in publicly financed research. For him it is just a question of how the leeway of the "self-regulating public research system" can be better utilized. In the opinion of the president of the Fraunhofer Society, Hans-Jürgen Warnecke, the answer is to be found both by industry and science. Warnecke emphasized that the process of finding alternative solutions between the two systems is not adequate. The public research institutions are not sufficiently meeting their debt of producing results for industry, and industry on the other hand is showing failure to discharge its debt of itself aggressively consulting the institutions. Of

course, publicly financed research as a whole has always to investigate more than can even be used afterward, he said. A "hawker's tray offer" that did not do for so many present, because coordinated arrangements are necessary for efficient innovation processes, he said.

Numerous progress reports have made it clear, especially as regards the exchange of personnel, which is urged from all sides, that the process of finding alternative solutions between industry and science is not working properly at present. Whether cooperation projects have gone wrong because of the public's defensive attitude toward genetic engineering, mental barriers or a ministry's putting-off tactics, the need for action has become obvious. If industry has been confronted with a "phobia for the observance of secrecy" and the interest of the Japanese, who unlike German company representatives are permanent fixtures at the institutes, reform has been demanded on the public's part as regards competition of the universities, a new service and budget law and a mental change as regards opening up to industry. Carsten Krecklau of the Federation of German Industry could not find the big success, and urged a government commission that must tackle radical reform of the university sector, from the autonomy of the universities to possible study fees.

Industry and science have to get closer to one another. The conference's main message was that banal or that profound. A concluding recommendation was that the joint establishment of focus centers for problem-oriented research could be a first step in this direction.

#### Commentator Views Results

95WS0105B Frankfurt/Main FRANKFURTER  
ALLGEMEINE in German 7 Dec 94 p 14]

[Article by Kurt Reumann: "Quarterly Financial Statements Will Have a Fatal Effect. How Research Can and Cannot Help in Innovation"]

[FBIS Translated Text] The new "minister for the future" Rüttgers wants to make Germany stronger again, into an "innovation base." This is indeed necessary, but the fragile beginning of a new upswing must not detract from the fact that the economy is in a structural crisis. In the words of the head of the Association of Major Research Institutions, Jülich Professor Treusch, "We are too expensive in low-tech, and not innovative enough in high-tech. Low-tech markets are breaking away, and high-tech markets are not being captured. The fire brigade is being called."

But who is to act as the fire brigade? The Donors Association for German Science invited leading researchers and research managers to Essen to Villa Hügel in order to advise whether research could not at least provide a fire brigade. It is precisely the economically successful countries that are spending the most on research and development: Japan, the United States of

America and Switzerland. Behind them comes Germany, though lagging a bit behind, the more so because in recent years industry has cut its outlays for research and development. Nevertheless, German industry uses annually 50 billion German marks [DM] on research and development, and the federal government DM25 billion. Siemens AG board member in charge of research and development, Professor Danielmeyer, said criticizingly in Essen, "Our country's innovation strength is not in accord with this expense."

Why not? In order to answer this, it is necessary to distinguish between invention and innovation, between promising inventions and turning these inventions into marketable products and making practical use of them. In Essen there was agreement that in Germany things are still going better for inventions than for making practical use of them. There are startling examples of the fact that German inventions are being ignored in Germany and being successfully capitalized on in foreign countries. Information from science decisive for the future is in this country obviously often not reaching the right addressees in industry. The alienation between the two "cultures" of industry and science was diagnosed as one reason for this, especially as regards that part of research that is being done at publicly financed institutions.

It is the still artificial antithesis between non-utility research at universities (which physics and chemistry teachers in the schools even confess to) and the demand-dependent production in industry that is responsible for this alienation. But this antithesis no longer exists in the real world of research: Basic research is merging smoothly with applied research, and, conversely, stimuli for basic research are coming from applied research. On this account Constance philosophy professor Mittelstrass wants to be able to distinguish between knowledge-oriented (pure) basic research, application-oriented basic research and product-oriented applications research. Even this distinction is still much too sharp, especially since research and technology are entering into an ever stronger interrelationship with one another: "Technology is not just applications, but also the premise of science, which thereby itself takes on technological features," is Mittelstrass's analysis.

At least for leading researchers, this mutual dependence ensures tensionless relations with industry. For that reason Danielmeyer could count on agreement in Essen when he proposed for the purpose of increasing strength in innovation that both partners, the public research institutions and private industry, each make available for joint innovation projects DM5 billion of their annual research outlays. The electrical engineering industry has already named 200 topics for this purpose in a campaign paper. It clearly says here what the industry expects and needs in the next 10 years. Such lists of topics should be conferred on jointly.

A new point of controversy in the debate comes with this: time. Industry makes it quite plain that specific

problems have to be solved within a specific period of time. Warnecke, the president of the Fraunhofer Society, defined the time frame: 10 to 20 years for strategic long-term planned research in order to uncover new opportunities; 8 years for medium-term-targeted research for the development of new improved products, processes and services; and 1 to 5 years for short-term industrial research.

There is the danger that industry will also want to commit to medium-term or even just to short-term targets research at universities and Max Planck institutes. There was agreement in Essen over the fact that the horizon would be narrowed in this way and the future would be lost. "Industry's quarterly financial statements will have a lethal effect," Frühwald, the president of the German Research Association, warned. The short wind and demand dependence of applied research and development need the balance of independent basic research. It is precisely the representatives of industry too that insisted on this. They indeed know that it is often not possible to predict which research will be useful. Stock, a Schering AG board member, pointed out a study by the American physiologist Comroe on research for combating cardiovascular and lung disease: Successful clinical application followed in a few years in 40 percent of all cases in which pure basic research had been begun first. The new minister for the future will have to see to it that basic research is not neglected.

If the universities are to continue to play a leading role in this interplay and counterplay, they will, according to Frühwald, have to be relieved of the pressures of a highly brutish planned economy: There is no room left for research in institutions completely piled up with students. In order to be able to realize the ideal of the oneness of research and theory at universities, good students are needed, and not any number of mediocre ones. The president of the German Research Association charged the ministers of culture and science with excluding unqualified and uninterested people from universities. To the surprise of everyone, Erichsen, the chairman of the Conference of University Rectors, did not join in this appeal. He referred rather to the need to train enough researchers, developers and application specialists—and that is the task of the universities, he said. The conference of rectors, of course, would like to hear that the secondary-school final examination has been improved, so that unqualified people do not get into the universities.

It would be one-sided to make research and development, whether at public institutions or in industry, alone responsible for the weakness in innovation. Research needs a research-friendly social climate, and that is lacking. Queisser, the director of the Max Planck Institute for Solid-State Research, could tell a thing or two about the fact that the major nuclear engineering research centers have done successful catching-up work and enabled huge-scale easing of the strain on the power plant industry, but political acceptance has been lost.

German research is outstanding in other fields too, like chemistry and the biological sciences, for example, but development and applications are being moved to foreign countries because of public distrust. The German chemical industry invests DM1 billion annually in Japan - with devastating consequences for the German job market, precisely as regards jobs in research. The dramatic decline in some cases in the numbers of students in the engineering sciences and natural sciences is the sad response to this—an alarm signal.

The management shortcoming at universities, but no less in industry, is another story. The rigid budget law and the rigid service law are another nuisance. Managers of the economy and politicians who complain about weakness in innovation should start with these stories.

#### **Netherlands: Cabinet Official Details 1995 Science Budget**

*BR2112132394 Zoetermeer WETENSCHAPSBELEID in Dutch Nov 94 pp 9-13*

[Report by Janet McFisher: "Do Not Slash the Roots, Prune the Branches"]

[FBIS Translated Excerpt] [passage omitted] The 1995 science budget was sent to the Second Chamber in early November. Its main message involved a broadening and strengthening of the social basis for S&T research.

Subjects such as the policy program, science and technology, selection and implementation, effectiveness and suitability, and internationalization are all on the agenda. One important question may refer to the new subjects contained in this science budget. Secretary of State Nuis [for Education and Science] said: "The science budget does not mean a break with the past, we are only continuing what we have already been doing in recent years."

He illustrates with some examples the fact that we should be very satisfied with the Netherlands research infrastructure.

In recent years, the productivity and quality of universities in the Netherlands have increased dramatically. A total of 61 recognized research institutes have been established. The intention is for some of them to expand into influential, internationally leading research institutes. Over the past decade, the Netherlands Organization for Applied Scientific Research (TNO) and the Large Technological Institutes (GTI)—such as the Hydrodynamics Laboratory and the Netherlands Energy Center—have become more market-oriented. They have strongly developed, whereas state funding has remained equal.

The NWO [Netherlands Organization for Scientific Research] has been asked to devote particular attention to its scientific policy role in several fields, e.g., the desired division of resources among scientific areas in relation to scientific policy, and social influence on the

choice and implementation of research. The NWO's recently published long-range plan revealed the efforts which have already been put into redistributing resources among science fields and the fields in which further reinforcement is necessary.

Research institutes have become more internationally oriented. TNO, the National Aviation and Space Laboratory, and the National Institute of Public Health and Environmental Hygiene have been increasingly receiving contracts from abroad. Last but not least, the secretary of state pointed to the contribution made by the business community. Shell, Akzo, and smaller companies have been performing pioneering research in their own laboratories. Their interest in research is evident from the fact that over 5,000 companies have applied for the possibility of fiscal compensation to their R&D costs, which commenced this year. By reducing its burden, the state is making it possible for the business community to increase research investments.

The number of contracts awarded to research institutes has increased. The third flow of money to universities currently amounts to 1 billion guilders, according to data from the General Audit Office. These examples clearly show how much has actually been done in the field of research and science.

#### **Coalition Agreement**

As already mentioned, the 1995 science budget contains a policy program. Nuis said: "I realize that this program now looks quite different, now that the coalition agreement is assuming savings on the government's research spending." Since the end of the 1980's, the business community has also been spending less on R&D. This is a worrying development, since a high level of knowledge is indispensable for our economy's revival.

These observations make new demands on the cabinet's S&T policy. The secretary of state emphasizes that we must look for a new balance. As conveyed already in the government declaration, making state finances healthy is a major priority. All this requires a careful approach to savings, on the one hand, and to maintaining growth capacity and the knowledge infrastructure, on the other.

According to Nuis, this does not mean that we have to economize by slashing at the roots and trunk of the tree, but that we must wisely prune the branches. This will protect the basic facilities.

The government wants to involve other parties in society more closely in research, by giving them influence and by allowing them to bear financial responsibility. The cabinet will talk to the business community about these aspects.

#### **Policy Program**

The S&T policy priorities are mentioned in the first chapter of the science budget. These six points are considered by the cabinet to be policy guidelines for the coming four years.



Firm choices have to be made. The roles of the Consultative Committee on Research Opportunities (OCV) and the sectorial councils will therefore have to be strengthened. The OCV, the sectorial councils, and the departments will draw up a plan of approach. Research must contribute to a reinforcement of the economic structure and the promotion of ecological durability. In addition, scientists must make a maximum contribution to ensuring that research is socially and ethically acceptable. Researchers and society together will have to determine where the boundaries are to be drawn.

The second policy line is the definition of interests, financing, and interaction. The aim is to involve the business community and social bodies more closely in fundamental research. The level of research can be kept up to standard through collaboration and joint financing. More attention will also be paid to how the research world and the people who work there are organized.

Given the recommendation by the Advisory Council for Scientific and Technology Policy (AWT), the cabinet will develop a strategy to facilitate a more independent policy for fundamental research institutes. It will do this together with NWO and the Royal Netherlands Academy of Sciences (KNAW).

In addition to an efficient infrastructure, good researchers are of vital importance. A joint Netherlands/Flemish action plan will be developed to solve problems such as the aging of the population and the lack of mobility.

One other point for attention is "science, culture, and information." During the first half of 1995, the Vonhoff Committee will make recommendations on the "Future of the Humanities." The study of humanities is under great pressure; its position within the university is not comfortable. However, a definite revival is under way in the field of Dutch language and culture. In the renewed Dutch Language Union, the Netherlands and Flanders are demonstrating their special responsibility for the Dutch language.

Growing attention for the international cultural policy leads to interesting prospects for the shady area between science and culture. However, developments are also afoot in the information function, which has always been one of science's most visible contributions to culture. Scientific libraries, where a huge chunk of our heritage is stored, are under threat: If we do not start conserving quickly, some of our historical books and archives will simply crumble away. The cabinet wants to find a satisfactory answer to the questions raised by technological developments in the field of information. A policy vision concerning the electronic highway will soon be published. Entirely new legal and organizational relationships are being formed between producers and users of information.

A fifth point is internationalization. The Netherlands must take even more advantage of international processes. This implies achieving the correct balance

between international facilities and programs (for example, the Megascience Forum). Together with Economic Affairs Minister Wijers, the secretary of state will carefully consider the European Union's fifth Framework Program. Collaboration with a restricted number of countries in a restricted number of fields is desirable.

Finally, there is the "knowledge and sectorial policy." The cabinet wants to link research policy to the impact it has on the social sector. One example is the thorough analysis of health research. The last part, on university research, will soon be published. The cabinet will then formulate a viewpoint covering the field as a whole.

#### Government Role

So what exactly is the government's responsibility in this matter? The government's primary tasks are to maintain fundamental research, which focuses on purely scientific questions, and strategic fundamental research, which is more long-term oriented. In addition, the government must also provide an adequate knowledge infrastructure to do justice to the interaction between demand and supply.

Basic research is important because it forms the entirety of the roots. Basic research usually involves risk-bearing long-term research. Unlike applied research, it is unclear whether and when the efforts put into it will contribute to trading results. Basic research contributes to a large extent to applicable knowledge. Sometimes it unexpectedly forms the basis of innovations. Many social and industrial breakthroughs have resulted from fundamental research. Without research into molecular biology the AIDS virus would never have been discovered; without fundamental research into lasers there would have been no compact discs to enjoy, and without sociological research we would not have known how the labor market operates. Basic research is also indispensable for the training of researchers. It puts them in a position to develop and to practice their creativity and mental powers, as well as forming a breeding ground for the study of science. Maintaining good facilities in the field of fundamental research is certainly therefore one of the tasks of the government.

#### Cofinancing

Government responsibility also includes the structural financing of organizations that specialize in applied research. These organizations have to be in a position to serve the business community and social organizations not only now, but also for many years to come. Constant renewal of the expertise basis is then an absolute necessity. Experience has shown that individual market operators are rarely, if ever, able or willing to bear the costs of this entirely on their own. [passage omitted]



**Spain: Subsidies for 32 New Research Projects***BR2312115594 Madrid EFE in Spanish 1904 GMT 21 Dec 94*

[Unattributed report: "Center for Technological and Industrial Development Approves 1.4 Billion Worth of Subsidies for 32 R&D Projects"]

[FBIS Translated Text] Madrid, 21 Dec (EFE)—The Center for Technological and Industrial Development (CDTI), which depends on the Industry and Energy Ministry (MINER), approved 1.4 billion pesetas [P] worth of subsidies for 32 new Spanish research and development projects, including a project to develop new anticarcinogenic substances from marine compounds.

The projects, 27 of which will be conducted by small- and medium-sized enterprises, will cover four main areas: agro-food industry and improvement of natural resources; advanced materials; life quality improvement; and computing, communications, and production systems and technologies.

This brings the overall amount of subsidies granted by the CDTI in 1994 to P18.725 billion (distributed among 361 research and development initiatives). This is 36 percent more than the previous year, according to a CDTI communique.

Twenty-seven of the new projects will be financed through privileged low-interest loans, while R&D projects carried out in cooperation with public research organizations will receive interest-free credits. One of the projects will develop a new intelligent fuel gauge system. Other subsidized projects will focus on a microchip-based smart card, improved aircraft components, a system to preserve sunflower seeds in nitrogen, the development of new antiviral agents, a new bag for extracting and preserving blood, and an electronic sewing-machine.

**Poland: Joint Venture with AT&T, ComputerLand Described***95WS0087A Warsaw RYNKI ZAGRANICZNE in Polish No 113, 20 Sep 94 p 7*

[Article by Slaw: "Collaboration Between AT&T and ComputerLand Poland"]

[FBIS Translated Excerpt] ComputerLand Poland has in recent months become the largest AT&T system integrator in Poland. The partners are collaborating more and more closely, successfully setting up even the most complex information enterprises.

Customers of ComputerLand Poland, for whom SYSTIMAX PDS AT&T cable network structures have been designed and installed, include: a Coca-Cola plant in Niepolomice, the headquarters of Polish National Bank, Fiat Auto Poland in Tychy, Thompson Polkolor, C.

Hartwig in Gdynia, Elektrociepłownia [Electrical Heating Plant] in Zeran, and "Stomil" in Olsztyn.

The fact that the largest AT&T system integrator ComputerLand Poland participated in the seminar in Atlanta, represented by its general manager Pawel Piwowar, testifies to the status of this firm. This was the first time a Polish firm had been invited to participate in this kind of a meeting.

The interest in services offered by AT&T and ComputerLand is dictated by the fast growing demand in Poland for efficient access to information and information exchange as well as information dissemination systems. Telephone and computer-aided communication systems do, despite their technological advancement, require interconnections between individual work premises. [passage omitted]

AT&T's Bell Laboratories have proposed a universal solution: the AT&T SYSTIMAX Premises Distribution System, easy to install and adaptable to changes as well as easy to manage and maintain. It facilitates creation of a single universal open cable network with a modular structure covering either one building or a cluster of objects within a given area. Moreover, UTP cables produced by AT&T facilitate data transmission at rates up to 100 Mbit/s. With the AT&T SYSTIMAX PDS system, transfer of work premises may require merely transfer of the apparatus, its connection to another outlet, and a simple switch-over on the administrative panel.

**Poland: Achievements of Science Research Committee Outlined***95WS0086A Warsaw TRYBUNA in Polish No 256, Nov 94 p 7*

[Article by Prof. Witold Karczewski, Chairperson of Science Research Committee: "Government a Year Later: Achievements and Failures"]

[FBIS Translated Text] I will begin with what has not been achieved. We have not yet managed to persuade the political power elite, beyond a verbal acknowledgment, that investment in science is investment in the country's future and not in a parasite which eats up financial resources. After all, the pragmatic Americans have figured out that one dollar invested in science may earn anywhere from one and a half to seven dollars: seven dollars in the case of "high tech" and thus in information science, new materials, and space research.

Despite the fact that Poland continues holding a very respectable position in worldwide scientific accomplishment, this has not been duly understood in the country. Science's share in the gross national product was increasing in 1990, to be sure, but unfortunately was decreasing in the later years. The projection for 1995 is 0.529 percent of the GNP. The Science Research Committee pleaded for at least 1.0 percent, which would

agree with the government's earlier projections. Inasmuch as this is merely a scientists' fantasy, the government will gain only one half of what is really needed.

The method of subsidizing scientific research in Poland has undergone a profound change, a not only thorough but also painful one. The world praises us for that, implying that other Central-Eastern European countries ought to follow Poland. It somehow seems, however, that we are being punished for having reformed. At least we are not being rewarded. This is indeed a failure and this is what worries me a great deal.

Now let me talk about a matter on the borderline between bad and good news. There still does not exist a science lobby speaking with one voice. Since the old days divisions are still made into three famous (or notorious!) "science departments." The Polish Academy of Sciences was engaged in science with a capital "S." Higher educational institutions taught, while research-and-development [R&D] units, then called departmental institutions, were doing practical scientific work. Residues of the past period are still there. These divisions thus fatally limit the possibilities in our budget battle now, because we do not speak with one voice. However, even here one sees an appreciable improvement.

It so happens that the three "science departments" are finding a common ground so that the divisions between them become blurred. The Polish Academy of Sciences (PAN) plans to join in the teaching process. Higher educational institutions conduct research, while so-called R&D units are definitely active in applied sciences as well as in basic sciences. Progress in this area is quite evident.

Above all, I emphasize again, it was possible to introduce a very modern science funding mechanism. Money is received for quality of scientific work, its quality being based on merit, for the measurable number of scientific publications and doctoral theses, and for status reached in a given field by either an institution or an individual

person on the world scene, i.e., vis-a-vis the most developed countries. Changes in mentality, though most difficult in this area, have been most successful here. After all, in the past we were used to receiving money without anyone asking for the results.

Now we do very impudently ask for results. All institutions are ranked: universities, PAN departments, and R&D units are all graded on a scale of categories. The classification is not rigid, there is room for promotion to a higher and demotion to a lower one. What I like best, I admit privately, is that sometimes the departments request only a change of category without a change in funding. A great prestige is attached to being in category A, the highest.

The second place where matters are improving well is in the grants (for research projects) awarding system, over 80 percent of the science community being in favor of that. Three things please me here. First, the system now encourages young people. We will be threatened by a generation gap, if we do not concentrate on this problem. Second, one of the grants awarding subsystems and namely awarding goal-oriented projects gets an input from industry, which pays half the cost of converting results of research into something real. Here we are facing a technological gap which also threatens us. The third nice thing are "commissioned projects," projects commissioned by provincial governors and by ministers in the central government. Such projects stimulate realization of important tasks called for in departmental policy or regional requirements. Examples are utilization of geothermal energy, war against unemployment, development of an "Eastern Wall," and a strategy for stimulating the economy of the Tarnobrzeg Voivodztwo [Province]. This is a particularly sharp tool now more and more often used.

All research projects pass through a fine sieve of critical reviews. There are no other mechanisms at work here but the meritorious ones. The success rate is of the order of 25 percent; that is, about one of four projects submitted receives a subsidy. All projects are still thoroughly evaluated so that no scientific research work should go to waste.

### European Ministers Agree to End Telecom Network Monopolies

95WS0110A Duesseldorf VDI NACHRICHTEN  
in German 25 Nov 94 p 4

[Article by Regine Boensch: "A Milestone in Telecommunications. Ministers End National Network Monopolies—Private Competitors Backing Alternative Infrastructures"]

[FBIS Translated Text] *Brussels—Under the direction of Wolfgang Boetsch, who had just taken his oath of office only hours before, the EU Ministers for the Post and Telecommunications came to an agreement on an "historical event." Since Thursday of last week it has been clear: As of the 1st of January 1998, the telephone and network monopolies held by national postal companies will no longer exist in the EU.*

Wolfgang Boetsch is visibly happy: "Having the game on hold is now over for German Telekom," he pointed out Friday of last week. The planned dissolution of all telecommunications monopolies in the EU as of 1998 would give state as well as private companies planning certainty.

But the "historical decision," as Boetsch calls the Brussels agreement, still leaves some things open. Particularly since the assembled Ministers could not agree on one very decisive point in Belgian: beginning when could the alternative network infrastructures be used? These networks include communications paths for power suppliers as well as for the railways. Thus, networks whose operators even in Germany count among the largest potential competitors for Telekom.

The four EU countries—Great Britain, Germany, the Netherlands and France—together with the acceding countries of Sweden and Finland were able to agree to have a commission now deliberate on the authorization of each alternative network. Decisions which are more concrete could still be made in December of this year. Especially since the chairman of the EU Council of Ministers for the Post, Wolfgang Boetsch, is pushing for a quick decision.

"I have always maintained that there would be alternative networks already in 1994," telecommunications manager Candace Johnson says. "Now the whole thing is being pushed back a bit. Still, there will be alternative networks in Germany next year," the vice president of the Iridium satellite project is certain. The nine big players in the market—from the power suppliers Veba and RWE [Rhine-Westphalian Electric Works] to the German Railway AG—will not be held back.

Initial reactions from Veba to the ministers' decision were somewhat subdued. Yes, there would be a certain planning security, but still we are not completely satisfied, spokesman Norbert Jaeger explains. The reason for the dissatisfaction on the part of the Duesseldorf power supply company: Veba has already filed an application

with the Ministry of the Post for an alternative network. Together with the German Railway and potential customers like ARD [Working Association of Public-Law Broadcasting Facilities of Germany], competitors to Telekom want to make their presence felt as quickly as possible. Some insiders on the telecommunications scene are now already warning against a network-duopoly by the power supply companies Veba and Telekom.

But there are also similar applications for using alternative infrastructures lying on the Minister of the Post's desk from the new cellular phone operator E-Plus and the German Research Network (DFN). And other imposing names like the new alliance around RWE, Mannesmann and Deutsche Bank or the energy company Viag dare not let the chance slip by to get into the lucrative telecommunications business.

He does not have a fixed schedule for opening up the private telephone networks, Wolfgang Boetsch said in an interview with the news agency Reuters. He says he will examine each case individually.

The German Industrial and Trade Association (DIHT) is characterizing the dissolution of the network monopoly as a milestone in the development of telecommunications in Europe. It will give the market the planning security it has long hoped for.

Even Telekom is welcoming the decisions in Brussels. At the same time, however, it warns against an "uncontrolled giveaway of alternative networks." Outline conditions dealing with infrastructure contract or price formulation must in the view of Telekom be determined beforehand. In this, Telekom is also in agreement with the German Post Office Workers' Union. Union head Kurt van Haaren: "The premature admittance of alternative networks has struck the financial nerve of Telekom."

There is no doubt that the dissolution of the monopoly sector alone touches the German Federal Post Office's subsidiary and future stock cooperation to its core. Seventy percent of all its business is in the monopoly sector—the greatest part of this from telephone rates. "With the decision by the EU Council of Ministers we have blazed a trail in the direction of the U.S.," according to Telekom's press office. "AT&T can no longer reproach us that the European markets are imperious." However, it has also been heard said at the Bonn company that the Americans must also take themselves to task. Since [in the U.S.], European and Asian companies may acquire a maximum participation of 20 percent.

With agreement on the 1998 deadline, the prospects for the planned alliance among German Telekom, the French Telecom and the American company Sprint—the third-largest U.S. carrier—might well improve. Wolfgang Boetsch is just as convinced of this as the London analysts from Merrill Lynch are.



"In the next three years, large alliances will form all over Europe from companies which are getting ready for the opening up of the markets," Sean Phelan, chief analyst at the consulting firm of Yankee Group Europe, explains. "The winners will be companies which quickly install fiber optic cable and, in the process, know how to handle bureaucratic and legal hurdles."

For analyst Phelan, the breakup of the monopoly also certainly means a significant decrease in costs, particularly for companies with international operations. "Today, telecommunications services in Europe are expensive," Phelan explains in this context. A current study by the consultant shows that in Germany leased circuits alone are twice as expensive as in France and nearly seven times as expensive as they are in the U.S. That will change.

[Box, p 4]

#### Telephone Monopoly

*By telephone monopoly, a monopoly on the transmission on speech for others is understood in which storage of speech and conversion of speech signals (for example, converting information into computer language) is not included in the telephone monopoly.*

*According to the Law on Telecommunications Systems (FAG), this exclusive right belongs to the Federal Government, where the authority to exercise this right was transferred to the DBP [German Federal Post Office] Telekom.*

#### Network Monopoly

*The network monopoly is the right of the Federal Government to establish and operate transmission paths including the termination installations belonging to them. This also applies to radio installations (radio installation monopoly). Here, too, the Federal Government has transferred the authority to exercise this right (network monopoly) to DBP Telekom. According to FAG, licensed exceptions are possible in limited "wireless" areas such as mobile phone or satellite phone transmission. Through the network monopoly each party which offers telecommunications services in Germany for third parties must reach back to the "sovereign" network.*

*The license agreement of the (digital) mobile phone operators contains in this context an additional exemption provision: Operators were permitted the use of their own radio relay links to connect the base stations with each other and with the mobile transmitting stations—but not the mobile transmitting stations with each other. [end box]*

#### European Development, Plans for Digital Audio Broadcasting Noted

95WS0100A Duesseldorf WIRTSCHAFTSWOCHE  
in German 1 Dec 94 pp 112-114

[Article by Burkhard Böndel and Götz Hamann under the rubric "Technology and Innovation. Digital Radio":

"No Crackling. The VHF Radio Will Be Replaced by the New DAB Medium. After the GSM World Standard for Mobile Radio, the Europeans Could Be Writing a New Innovation Success Story"]

[FBIS Translated Text] The managers of the Philips, Siemens, SGS Thomson, Temic and Bosch European electronics groups this year are like children awaiting in a fever of anticipation the Christmas holiday. The European Telecommunication Standards Institute wants to adopt by the end of the year a uniform standard for digital radio (Digital Audio Broadcasting, DAB).

Manufacturers are expecting splendid business for themselves for years to come. With DAB, radio will become a multimedia platform, and even more: "DAB will become an extended arm of the information superhighway," believes Ulrich Sieben, technical director of ITT Intermetall in Freiburg, which has developed a chip set for digital radio. The new medium could, just like the European GSM [Global System for Mobile Communications] standard for digital mobile radio, develop into the world standard, experts believe. "There is nothing to compare with it in the world," gloats Frank Müller-Römer, technical director of Bayerischer Rundfunk [Bavarian Radio] and chairman of the so-called DAB Platform in Munich, which is acting as a lobby for the new medium.

DAB has decisive advantages over time-honored radio:

- **New value-added services:** Not only music and voice will be broadcast through DAB, but any information one desires, such as traffic reports, graphics, tables, text or images. DAB radios have an LCD [liquid-crystal display] screen for displaying visual information. So-called service providers can offer stock quotations, for example, and sales chains can provide their stores with price changes. During a commercial spot the marketer's telephone number will be inserted, and the up-to-the-minute score for sports events. When music is being broadcast, the title and name of the interpreters appears, as well as, synchronous with the music, the words.
- **Better sound:** No static, hiss, crackling, buzzing, gurgling or unintelligible words interfere with listening pleasure. The signal that whizzes through the air consists of a tremendous bit stream that is decoded and emitted by analog means through the loudspeaker and display. Digital radio's sound quality reaches the level of that of a compact disc.
- **Better frequency economy:** The new transmission and reception technology makes possible one- to threefold greater program density with the same frequency range. With digital technology the cost of blanket-coverage broadcasting is 40 percent that of the analogue method. There has been CD-quality radio since 1990. Deutsche Satelliten-Radio (DSR) is broadcasting 16 cultural programs via the Copernicus artificial earth satellite. Additional potential sellers are waiting in the wings. In 1995 additional broadcasters

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like the Luxembourg Astra Group also want to go in the direction of broadcasting with digital radio (Astra Digital Radio, ADR). The World Radio Network—a union of 10 different broadcasters—wants to start, also via one the Astra satellites, a digital radio program; the pay-radio seller Digital Music Express (DMX) from the USA is planning its leap across the Atlantic; and the EUTELSAT [European Telecommunications Satellite Organization] union of European telecommunications companies also wants to offer digital radio as of 1995.

The handicap of all these offerings: The broadcasts cannot be heard in one's car because they are let in via an antenna that has to be precisely oriented. On the other hand, 80 percent of all receivers are portable or car radios.

DAB is aiming precisely at them. "This is the first radio system that has been developed especially for mobile reception," says Egon Meier-Engelen, DAB project leader at the German Aerospace Research Institute in Cologne.

The first pilot projects will begin in the middle of next year in Bavaria, Baden-Württemberg and Berlin-Brandenburg. The assembly of the broadcast networks has already been covered by contract. Forty-two million German marks [DM] have been invested in Bavaria alone. The Bavarian state government is contributing DM27.2 million. The heavily populated areas of Nuremberg, Ingolstadt, Munich and Rosenheim are test areas. Five thousand motorists are getting DAB receivers that are being manufactured by Grundig and Philips among others. More than 20 companies want to offer additional data services. Other states like North Rhine-Westphalia, Rhineland-Palatinate, Saxony and Thuringia are also planning to start digital radio. France and Great Britain are already ahead: Field experiments have already begun in London and Paris.

Canada also wants to introduce DAB shortly. Test broadcasts are under way in Toronto, Montreal, Vancouver and Ottawa. Australia, China and several Eastern European countries also have their feelers out.

Europe's industry is best prepared. "The engineering development phase has ended," says DAB thinker-ahead Müller-Römer. A good 20 electronics manufacturers have been supported with a total of DM180 million within the framework of the EUREKA [European Research Coordination Agency] European research program. The cost of the sets, which still comes to a steep DM3500 in the pilot projects, is to drop drastically in the years to come.

A DAB chip set still consists of up to 12 individual devices. In the future one or two chips are to handle the same tasks, so that the cost, dimensions and power consumption will drop. Werner Saalfrank, development head at Grundig AG [Inc.] in Fürth, accordingly figures

that a mass market will open up in the next three years and DAB will replace VHF receivers in car radios and portable radios.

The British BBC has decided to assemble a blanket-coverage DAB broadcasting network as of the end of 1995. The Germans are moving more stodgily. Whether DAB will be introduced nationwide after the pilot tests in 1997 is presently the subject of media policy squabbling. The Federal Republic of Germany Association of Public Radio Institutions (ARD) and the German Postal Service's Telekom are ready to assemble the broadcast networks—at least theoretically. "We are for DAB and are doing everything that is in our power," NDR [North German Radio Broadcasting Company] Director and ARD Chairman Jobst Plog says. But: "We do not have the money for providing blanket coverage." DAB is "simply not in there" within the framework of today's fees, Plog says. The estimated cost for ARD: around DM500 million. Last year the 16-member group of directors of ARD then for the first time also rejected the introduction of DAB. The ministers-president of the states countered this a little later and decided on starting in 1997.

The fee-payers will no doubt have to raise the money for financing the new technology: The contract in question runs out on 31 December 1996.

#### DAB in Germany

- Mobile CD-quality reception
- Additional requestable data services (traffic information)
- Inserted information (score during sports broadcasts, weather maps, telephone numbers)
- Connection to the information superhighway
- More programs with the same frequency range
- Lower costs for broadcasters

Actual projects are under way in the areas of Cologne-Bonn, Berlin, Nuremberg-Munich and Mannheim-Stuttgart-Freiburg. There are expanded plans for Cologne-Bonn and the Magdeburg-Dresden-Erfurt area.

#### Technology

##### How DAB Works

Digital radio will bring two important changes: noise-free reception and the broadcasting of additional information besides the actual radio program. This requires every trick of microelectronics: An intelligent compression algorithm compresses the voluminous musical information together to less than 20 percent of the original information, in order to keep the frequency range as small as possible. Six programs are combined into a single data block and broadcast at the same time. For this purpose 1536 carrier frequencies are used, which are distributed over a bandwidth of 1.5 MHz. Each program is thus divided into 256 pieces. The receiver in milliseconds puts the data salad together in

the right order and picks out for itself from the six programs just the one selected.

There is on purpose a tiny time lag between reception and reproduction. The receiver uses it in order to reconstruct data packets that are lost in transmission. Reflections of radio waves at obstacles are also used for this purpose. While VHF reception is disturbed by reflections of this sort, they strengthen the DAB signal.

#### **France: Existing Information Highways, Networks Reviewed**

95WS0107A Paris 01 INFORMATIQUE in French  
11 Nov 94 p 36

[Article by Alain Laidet: "Large-Scale Plans: Information Highways That Intersect Almost Everywhere"]

[FBIS Translated Text] *The region is teeming with somewhat advanced and less advanced projects for information highways. There is no lack of initiatives—some private-sector, some public-sector, and some mixed—even though the ends sought are not all of the same order. A bird's-eye view.*

The Rhone-Alpes Region will have cable or it will not. That is the sensation one gets listening to the partisans of the various information highway projects that are sprouting throughout virtually the entire Region. At least five of them are noteworthy. The oldest and most advanced concerns the Department of the Rhone. In 1990, the General Council issued a call for bids on a project, the only one of its kind in the Hexagon [France]. It called for the fiber-optic cabling of the Rhone Department's 293 communities, with provision for 300,000 potential service drops. The intent is to provide the Rhone Department with a high-bit-rate interactive infrastructure that will enable each inhabitant, business enterprise, and public-sector administration to have access to the network, with types of interconnections specifically suited to each category. It is a regional development project with political backing led by an elected official of a west Lyonnais rural canton, Senator Tregouet, who advocates equality of opportunity for the rural towns and villages with respect to these new infrastructures. After a third European call for bids, issued this year, the project appears to be about ready to take off. Two cable-operating entities have indicated interest: France Telecom, on the one hand, and a consortium named Rhone Vision Cable, on the other. The latter is controlled by a majority of French enterprises, and includes Alcatel and Time Warner. The bidder finally chosen must undertake the financing of two thirds of the overall cost of the project, estimated at 970 million French francs [Fr]... if the General Council validates the project. The vote on this question is expected to be taken before the end of the year. If it is positive, the licensing association of communes will decide on the choice of cable operator.

On the other hand, no specific plan has been drawn up for the development of services suited to this infrastructure. The operating entity will be free to graft other

services onto the required core cable television service. It is precisely on this new-applications aspect that a group based in Grenoble [Department of the Isere] is banking to advance its proposal. The local industrials there (Hewlett-Packard, Bull, Sun, and Itmi in the lead), have met together with the universities, the public-sector laboratories (CNET [National Center for Telecommunications Studies], INRIA [National Institute for Research on Data Processing and Automation], LETI [Laboratory for Electronics and Data Processing Technology]), and the local communities, under the banner of the "Grenoble Network Initiative," to explore these new uses and their associated technologies. "The two major stakes involved are the provision of means to the agglomeration for testing high-bit-rate applications, and the facilitating of access to Internet by the on-site enterprises," says Jean Pierre Verjus, director of IMAG/INRIA. But before even thinking of infrastructures and a metropolitan network, the players have organized their approach around application projects. They have focused on five areas of activity: multimedia documents, health care, education and training, electronic marketing, and PME's-PMI's [Small and Medium-Sized Businesses - Small and Medium-Sized Industries]. Study groups that include all the partners will propose pilot applications that, if successful, will result in more-structured industrial projects. Actually, this "initiative" appears to be largely inspired by California's "Smart Valley" project, which brings the local industrialists together around some 60-odd application projects, including Commercenet, to cite just one of the more widely known ones.

#### **A Platform for Transnational Networks**

Similarly, the Grenoble planners are preferring to inseminate the information highway concept before turning their attention to the piping and fixtures. Some, however, are contemplating this next stage and would like to see the Isere region be the land of welcome to transnational networks. Others point out that AREA, the Rhone-Alpine highways concessionary company, has available 300 kilometers of fiber-optic arteries that traverse the region. These are all projects that will require expertise. The Isere region is not lacking in this respect. The Grenoble telecommunications community is estimated at some 2,000 specialists, a breeding ground that positions Grenoble favorably to become the "Sysop" (telematics network anchor) of these regional information-highway projects. The third type of initiative concerns the Department of Haute Savoie and the Department of the Loire, both of which are desirous of positioning themselves in the orbit of governmental initiatives with respect to information highways. Since the Thery report recommends local tests, the city of Annecy [Haute-Savoie] has put forth its candidacy, attached to another local project that calls for the creation of an "Image Pole." This project is still up in the air, but it calls upon the elected officials to aid in the creation of a multi-pole of activities (electronic publishing, "telemediatique," industrial applications of

imaging and simulation). An obvious synergy. And at the other end of the region [the Loire], the mayor of Roanne, Jean Auroux, who is also president of the Federation of Mayors of Medium-Sized Cities of France, is also said to be pressing for inclusion in the Thery testing. In short, there is no lack of intents, nor, for that matter, of competencies.

It is nonetheless a fact, at the present time, that the best regional incarnation of these information highways concerns the university sector, which is being "touted" in this connection by France Telecom. The Aramis regional network, launched in 1990, currently links 15 universities plus the Rank-Xerox research center, totaling some 10,000 machines, at speeds of from 64 to 1,920 Kbps [kilobits per second], with the entire network linked to the rest of the world via RENATER [National Telecommunications Network] at 34 Mbps. The financing of this entire venture was covered by an agreement signed on 27 October by France Telecom, the Regional Administration, the local communities, and the universities.

The future will tell how these five initiatives will develop, indeed how they will converge, in view of their seemingly extensive complementarity. But it is astonishing to note that, to date, they have been developed separately from each other. And this fact militates for a rapid networking of the region.

#### France: First European ATM Service Inaugurated

95WS0079A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 21 Nov 94 p 10

[Unattributed Article: "First European ATM Service—France Telecom: Transrel ATM Offers 'Quantum Leap' in Performance"]

[FBIS Translated Text] The French company Transpac is introducing Transrel ATM, the first European service for connecting local data networks (LANs) via ATM networks. According to the company, this service completes the Transrel services for high-speed transmissions of 2 to 25 Megabit per second. As France Telecom, Bonn, Transpac's parent company reports, the service is compatible with client/server architectures, and the Transrel access interface to ATM is adapted to conventional line arrangement protocols.

The company further states that the transmission rates constitute a "quantum leap" compared to previous technology. Transrel ATM allows communication with a wide range of speeds at attractive transfer costs. Compared to conventional leased lines, transmission costs in certain network configurations can be reduced by up to 35 percent for average line traffic. This is made possible by efficiently distributing the high-speed network among several users and thus fully utilizing the advantages of ATM technology.

According to the company, the service is already being offered in metropolitan Paris, Grenoble and Nice

(Sophia Antipolis). Starting next year, the service will also be available in other major French cities. As France Telecom states, the ATM (Asynchronous Transfer Mode) method is integrated into the basic structure of the France-Telecom-Network. This allows the use of an optimized data multiplex method as well as complete separation of the various virtual customer networks.

In addition, France Telecom wants to introduce a Corporate Network Service. This service meets the requirements of continuous or intermittent communications applications. Because of the flexible ATM bandwidth, companies with large customer networks can install a high speed backbone, i.e., external electronic data processing backup.

The company states that the first pilot customers will be able to try out this service in the spring of 1995. In the fall of next year, the service will be introduced in major French cities and will be expanded abroad via One-Stop-Shopping. The Corporate Network Service allows the transmission of voice, image and data communications and has access interfaces which are compatible with present systems.

#### Siemens Recruits US Partners for Interactive Multimedia Alliance

95WS0110B Duesseldorf VDI NACHRICHTEN in German 18 Nov 94 p 13

[Article by Gerd Krause: "Siemens Entering Information Highway with Partners"]

[FBIS Translated Text] Ordering movies of your choice electronically (videos on demand), telebanking with the PC, interactive video games using the TV, doing shopping over the TV screen—Siemens wants to get on the information highway with multimedia. Together with the cable television equipment [supplier] Scientific Atlanta and the Sun Microsystems (both U.S.) computer company, the Munich electronics group wants to offer operators of cable and television networks the very first ready-for-use complete approach to interactive multimedia service. To this end, Siemens joined with the U.S. company last Tuesday in a multimedia cooperative effort.

At the center of the new alliance is interactive television, particularly individual call-up of movies. According to Siemens, this concept looks more or less like this: the Sun computer company will make the database server available to the service providers. This mainframe handles the inventory of information services, movies and video games and conducts the electronic mail-order business. Scientific Atlanta supplies the so-called set-top box, also called a decoder or client. By means of this terminal hooked up to the television at the customer end, movies, for example, are called up at a video service which "pumps" them to the customer through the network. Siemens is primarily responsible for the interactive network structure consisting of wideband distribution networks and telephone networks between server



and client. The basis for this is to be IMMX-Press (interactive multimedia), a new development by Siemens for interactive services.

The initiative for the alliance began with Siemens. In the assessment of Dr. Fredy Welling, multimedia expert at the international consulting firm of Arthur D. Little, Duesseldorf, the cooperation is "really unique and points the way." In Siemens' view it is a "truly outstanding step in the right direction of acquiring technology which is not already available within the company by means of cooperation." Alone, Siemens would not have had the necessary authority or competence in either the server area or with the set-top boxes at the consumer end.

Siemens, the world's third largest equipper of public communication networks after the French Alcatel and the U.S.- American AT&T, brings into the alliance with its company's public communications networks sector its know-how as systems integrator and producer of transmission and switching technology. Sun Microsystems from Mountain View, California, is, according to its own statements, the world's market leader in workstations. Sun's strengths lie in open standards, experience in using workstations in distributed data processing and high-performance storage technologies, an important prerequisite for a multimedia server. Scientific Atlanta in Norcross, Georgia, is one of the world's largest providers of cable television installations, including the set-top box, which the television has to be equipped with for the new services.

Erwin Hardt, Siemens executive board member and head of public communications networks, the branch of the company involved in the alliance, gives this reason for the alliance: independent development of the technology now brought in by the cooperating partners would have taken too long; and the purchase of lacking technology would also not have come into question.

#### **Germany: Fiber Optic Transfer Device Developed to Aid Data Transmission**

95WS00081C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 23 Nov 94 p 8

[Article by JB: "Signal Regeneration Over Greater Distances—Technique From the Heinrich Hertz Institute Works with Phase Conjugation"]

[FBIS Translated Text] Frankfurt. When data are transmitted over fiber-optic cables they must be regenerated after a certain distance. This is done by repeaters, which also strengthen the signals. With today's oceanic fiber-optic cables, such a signal amplifier is necessary every 130 kilometers. The Heinrich Hertz Institute for Communications Technology (Einsteinufer 37, 10587 Berlin) has now developed a transmission technique which allows the distances between the repeaters to be increased substantially.

The technique uses optical phase conjugation. It makes error-free data transmission possible. In addition to the attenuation of the data over longer distances, dispersion in particular interrupts data transfer. This means that the initially rectangular digital pulses blur as they pass through the optical fibers, i.e., they lose their shape.

The cause of the dispersion is due to each pulse being made up of several frequency components. The higher frequency components make somewhat faster progress than do those of lower frequencies. As the transit gets longer, the pulses which were previously separated can in this way overlap and cause the transmission of information to break down. With the help of optical phase conjugation this can now be avoided. With this technique, the faster components of the pulses are, after a specific time, shifted to the pulse end, and the slower portions move to the front position. As the pulse continues, the higher frequency portions gradually catch up again. Finally, at the end of the transmission distance the pulse is once again in exactly the same form as it was at the start.

The Berlin Institute showed in an experiment done over a transit distance of 100 kilometers that the technique also works in practical operation. A semiconductor laser amplifier provided for phase conjugation midway through the stretch. With the amplifier, not only the dispersion caused by the transit but also the distortion from the fiber-optic cable could be compensated for.

The technique is, in the opinion of the Institute, an economical alternative to conventional repeater technology. Additional advantages accrue from material savings in the optical fiber itself. For high-rate transmission stretches, cheaper standard fibers can also be used instead of special dispersion-shifted optical fibers.

#### **Germany: Multimedia Developments Enhance Measurement, Control**

95WS0103B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 2 Dec 94 p 8

[Article by Rolf W. Goering: "Multimedia to Make Future Measurement, Control Technology More Efficient. Needed Measurement Instrument Set Assembled On Computer Screen. Software Links [the parts] Together"]

[FBIS Translated Text] Two important trade shows, the ACHEMA in Frankfurt and the Messcomp in Wiesbaden, have shown this year that the efficiency of digital measurement technology is currently experiencing enormous growth. Two trends here are at the forefront: multimedia developments are now fully entering computer-controlled measurement technology. Measurement technology and further processing of measurement data are becoming more closely linked.

Developers of equipment have recognized that data can not only be captured and documented. Once the data are



in the computer, they can be used for control [processes]. Measurement data can be visually represented, copied or transcribed and analyzed in any way desired. In part, this already occurs today with a level of perfection which could not have been hoped for a few years ago. Many industry observers see in this just the beginnings of a far-reaching development.

Computer programs displayed at this year's trade shows admittedly showed typical signs of transition. First there was the conventional equipment like voltmeters, pressure gauges and printers. At a second level of development, these pieces of equipment were shown with their capabilities with a computer.

The virtual instruments thus created were depicted in part still in the form of the old, familiar equipment, which gave the user the comfort of not having to get used to something new. One background graphic portrays the relationship to the actual measurement process.

The next, already multimedia step shortens and summarizes the measurement process by showing the actual processes on the video display screen. In this way the computer system itself becomes a measuring instrument: display systems and measurement instruments are no longer viewed separately but are instead hooked up directly with the object being measured.

The real-time instrumentation of an expansion measurement, for example, can be shown directly over the object being measured with the appropriate strain gauges. In measuring a car body, all points of measurement with their maximum values are depicted as a grid. If the operator wants to see details, a sliding instrument can be used to select the desired car body part, which then is displayed in a detailed picture along with detailed information regarding the measurement values belonging to this part.

This kind of instrumentation, which does not opt for the roundabout way [of imparting information] via a display instrument but instead directly shows the object to be measured along with its accompanying measurement values, is an important step toward greater simplification and a broader overall view.

But development does not stop here. All graphic processing, which up to now has served the purposes of visual representation, can furthermore be used to describe tasks which then become the means of approach for the desired measurement and open and closed loop control processes. The pacesetter in this new development is the software house GfS in Aachen.

The Diadem software just shown in the beta version confirms the new trend. The system which is designed as a PC workshop contains in the first topic bar a device selection which can be dragged into the workshop with a computer mouse. The assembled function blocks can be linked to the desired measurement system at three different layers (data lines, control lines and system lines).

The software behind the computer's user interface then makes this description of the measurement task into a functioning measurement system. Windows can be arranged on-screen to give the results for each task at hand. But voice output is also possible—equally multimedia. Audio communication which has so far barely been introduced into such systems will in the future make things easier for the observer monitoring the measurements who could easily become overtaxed due to the multiplicity of instruments which must be watched.

The measurement results can thus first be presented in multimedia form (with photos and later with video clips on the measurement process) and automatically also retrieved into reports where the object of measurement itself is the focal point of the graphic interpretation [of the data]. In this way very complex measurements can also be easily handled and automated, and data and tests can be depicted and documented clearly.

According to GfS managing director Dr. Ing. W. Melder, future development now demands defining the interfaces between sensors, PC cards, transmission and PC systems, so that all these various systems on the market can be combined into one single system. In this way a multi-purpose, streamlined instrument can be created which will combine the best qualities of all its parts.

#### **Germany: VDE Hopes to Gain Share of Autoelectronics, Telecommunications Market**

*95WS0124C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 15 Dec 94 p 8*

[Article: "U.S. Becoming World Leader in Microelectronics"; subhead: "VDE Sees Increasing Opportunities for Germany in Autoelectronics and Telecommunications"]

[FBIS Translated Text] Dresden—By the year 2000 international consumption of microelectronic products will increase even more greatly than presently assumed. This is the assessment arrived at by the Microelectronics Society of the Association of German Electrical Engineers (VDE). By the year 2000, international consumption will grow from \$77.4 billion in 1993 to nearly \$160 billion.

The forecast anticipates a further drop to 28 percent by the year 2000 in Japan's share in international consumption of microelectronic products. In 1991 it was at 38.3 percent and in 1993 at 30.6 percent. Japan has lost its top position in international consumption to the U.S. that had realized in 1993 a 32-percent share (1991: 28 percent).

In production, too, the U.S. has again become the world's microelectronics market with the greatest turnover. America's share in worldwide semiconductor production in the last two years rose from 38 to 42 percent. Accounting for the positive balance, marketing analysis

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cites the U.S.'s leading position in processors and the doubling of applied microelectronics in data technology. Since then, two thirds of consumption has gone to that applied area.

While the U.S. and Japan produce far more microelectronics than they themselves consume, production in Europe continues to lag far behind consumption. According to the VDE analysis, Europe's share in worldwide microelectronics production over the last two years easily declined to 10 percent whereas the share in worldwide consumption easily grew to 19 percent.

By the year 2000 in Germany, according to the report, the microelectronics market will grow to 12 billion German marks [DM]. In the previous year turnover was DM6.7 billion, and in 1991, nearly DM5.2 billion. Typical of the Federal Republic is microelectronics' steep 16-percent (1993) share of value in electronics used in automobiles. That share will grow to nearly 19 percent by the year 2000.

Microelectronics' share of value in the telecommunications sector will climb from the present 10.6 percent to 12 percent in the year 2000. A highly advantageous result, for instance, for the development of the multimedia branch, could be the excellent of the Federal Republic and of Europe in the future in telecommunications.

It is also claimed that the percentage of customized integrated circuit boards in microelectronics consumption will not grow as strongly as originally assumed. Instead, for example, in telecommunications, in the meantime, components have emerged on the market that the customer can quickly and inexpensively program.

In terms of technological progress, the VDE projects that in the year 2000, the silicon-technology-based single gigabyte memory chip will be practically realized. Germany and Europe will have better prospects than hitherto in the future to participate better in the success of the branch. Customized circuit boards "of European manufacture are well along the way to become an international standard." New superfast logic circuits with transmission rates of 40 gigabits per second for broadband systems have emerged from German research laboratories.

#### **UK: British Telecom Attempting to Reduce Overall Cost of Telecommunications**

95WS00081A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 23 Nov 94 p 8

[Article by P.O.: "Using the Phone Costs Almost Nothing Anymore—In England Intensive Consideration Is Being Given To Competitive Rate Structures"]

[FBIS Translated Text] London. In British telecommunications, the view is becoming increasingly accepted that fully automated modern systems are making the costs of an individual instance of use—whether of the telephone, fax or data transmission—so unbelievably low that it will finally be possible to sell the customer only the potential for use. Then, individual instances of use would themselves no longer be itemized or charged.

Naturally, it will take quite a while before such ideas precipitate concrete, far-reaching rate structures. This approach, however, is already starting to be felt in various ways. One example is that specific discounts on charges for future use can be sold for one-time payments. These price discounts could amount to as much as 20 percent of the otherwise applicable rate.

One of the new providers in the British telecommunications market, the electric power company Energis, is already letting the new approach influence its own advertising: "Because our network costs so little, we can guarantee our customers that they will always pay at least ten percent less than they would with British Telecom," as the ad says. At the same time, Energis is using a portion of the proceeds to provide at no charge specific core telecommunications data to small business users who would otherwise not be able to afford such analyses.

Such information includes not only the detailed listing of all instances of telephone line use, down to the one-minute local call, already customarily free in Great Britain. The customer is additionally informed how long on average callers have to wait until the phone is answered.

At the same time, a list is also kept of how many callers telephoned in vain because no one ever answered. Furthermore, lists are generated which not only identify the customer company's individual conversations in chronological order but which also identify the most frequent and the longest conversations, fax and modem connections.

### EU Commission Approves Thomson-DASA Military Joint Ventures

BR2012142394 Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 9 Dec 94 p 15

[Article by Jean Dupont: "Green Light for Thomson-DASA Alliance"]

[FBIS Translated Text] The European Commission has just given the go-ahead to the two joint venture projects between Thomson-CSF and Deutsche Aerospace [DASA] announced last summer. These projects should materialize on 1 January with the creation of several divisions.

The first, Thomson-DASA-Armement (TDA), a 50-50 percent joint subsidiary of both groups, will be based in France and specialize in intelligent munitions. It will recuperate the capital of Thomson-Brandt Armements in this field (900 million francs [Fr] in annual turnover) and of Wirkssysteme (Fr500 million annually). TDA will have a subsidiary in Germany called TD Wirkssysteme.

The second, Thomson-Bayern Chemie (TBC), another equal joint subsidiary, will be located in Germany and specialize in tactical missile propulsion. It will have a global turnover of Fr500 million, of which Fr100 million will be realized by a French associate subsidiary. Known as Protac, this subsidiary will benefit from the capital of Thomson-Brandt to the tune of Fr100 million in annual sales.

According to Brussels [EU Commission], this merger is not an infringement of commercial competition. Despite its expansion, the new group remains modest in size compared to Celerg, the joint Aerospatiale and SNPE [National Society of Powders and Explosives] company. In munitions, and notably in mortars and missiles, its main competitor remains Royal Ordnance, the British Aerospace subsidiary, which has agreements with GIAT Industries.

### Germany's Gildemeister, Cincinnati Milacron Partnership Contemplated

95WS0094A Paris L'USINE NOUVELLE in French 24 Nov 94 p 26

[Article by Daniel Chabbert: "Gildemeister and Cincinnati May Form Links"; introductory paragraph in bold-face as published]

[FBIS Translated Text] The serious talks underway for the past few months between the two manufacturers will reportedly lead to a commercial or industrial agreement or perhaps even an exchange of capital.

Rumors about an imminent agreement between Gildemeister and Cincinnati Milacron are growing very insistent in Germany. Talks between the two machine tool builders began several months ago and are reportedly at a very advanced stage, and the participants are said to be open to any type of partnership. Some people are talking

about a possible reciprocal agreement, others go so far as to mention an exchange of capital between the German and American firms. Between those two extremes, an industrial partnership is also being contemplated.

People are much less talkative on the other side of the Atlantic. Cincinnati Milacron puts its talks in context by explaining the many contacts it has had in recent years with several machine builders—German in particular. Over the past four years, during which it has been refocusing on its most flourishing activities—having sold its robotics and measuring machine divisions in particular—the U.S. group is seeking to join with a foreign manufacturer to develop its export markets. That is a radical change in Cincinnati Milacron's marketing strategy, since it currently exports less than 30 percent of its production.

On the other hand, the German firm is growing more insistent. It must be said that the manufacturers across the Rhine have been greatly weakened by the past four years of recession, which have led to a number of bankruptcies and an unprecedented concentration of supply. The Gildemeister group, for example, has seen its activity drop by over 50 percent in five years to a level of nearly 2 billion francs [Fr]. And it has lost nearly two-thirds of its employees during the same period. But that has not prevented it from rounding out its catalog by absorbing the Deckel and Maho brands.

### Standing up to Japanese Competition

Those buyouts are not improving its accounting situation, however. The acquisition, which was orchestrated by its bank, WestLB, resulted last October in a capital increase of nearly FR250 million thanks to an issue of shares on the Duesseldorf Stock Exchange. That injection of new money is making it possible not only to improve the group's balance sheet but also to finance the final restructuring operations at Maho and Deckel.

Despite the recovery now in the offing, Gildemeister and its fellow firms know that conditions will never be what they were in the past. The pressure on the price of equipment goods has every chance of continuing. And the mere label "Made in Germany" may no longer be enough to ensure one a place in the market. Hence the idea of joining with Cincinnati Milacron so as to attain critical size and put up a better front against Japanese competition.

However, their possible agreement does present a fundamental problem: the harmonization of products. Both companies manufacture a complete range of lathes, milling machines, and machining centers with more or less identical capacities. So what might they come up with? A distribution agreement in Europe and the United States, a sharing of world markets, or joint research and development? Whatever the case, a drastic rationalization of production sites and commercial networks will be inevitable.



### Deckel, Maho: Drastic Reducing Treatment

Deckel and Maho, which are now an integral part of the Gildemeister group, have seen their activity decline by half over the past four years. They now account for a combined turnover of no more than about 1 billion francs and have around 1,000 employees.

Three out of five production sites have been kept. Universal milling machines at the middle and top end of the market will be manufactured in Pfronten in Bavaria (Maho's former headquarters), while machining centers will be produced in Geretsried near Munich (formerly a Deckel plant), and small milling machines and mechanical parts for all three plants will be produced in Seebach (in the former GDR).

### Mercedes Trucks Division, France's Noremat Merger Reported

95WS0098A Paris L'USINE NOUVELLE in French  
1 Dec 94 p 28

[Article by Olivier Mirguet: "Small Lorraine Company Joins With Mercedes"]

[FBIS Translated Text] Noremat, which builds roadside maintenance equipment, has been picked by Mercedes to provide the mowing and ground-clearing machinery for its 4-wheel-drive U90 truck.

"I met for the first time with Mercedes technicians only a year ago. Today, the product we developed together is operational." For Jacques Bachmann, CEO of Noremat, a company based in Ludres (Meurthe-et-Moselle), the signing last September of a cooperation accord with the German builder came at just the right time. The company, which has been building and repairing mowing equipment for 13 years, has adapted a ground-clearing machine, the "M5," to fit on the small U90, the premier model in the Mercedes-Unimog 6-ton line. Thanks to this partnership with Mercedes, it will now be able to realize its export ambitions.

It all happened very quickly. Last year, Mercedes Industrial Vehicles, which already has supply contracts with 150 French firms, was looking for French accessory builders to help boost sales of the Unimog line. At a trade expo in Bordeaux, Bernard Pujos, director of special markets, state agencies, and local governments for the Unimog division of Mercedes France, met Noremat's president-general manager. And the latter showed him the Noremat ground-clearing machinery that was adaptable to agricultural tractors. In October 1993, Mercedes engineers traveled to Ludres, on the outskirts of Nancy, to draw up a work order with Noremat management. The key requirement: The truck must be stable in all utilization modes, both at 90 km/hour on the road, and when the 6-meter-long mowing arm is deployed. Noremat delivered the first prototype early last summer.

"The big advantage of the M5 is that the weight is distributed perfectly evenly over the four wheels supporting the engine," says Bachmann, proud to have met the challenge. After digesting comments made by the German engineers, performance tests were completed in October. "The machine has been available from our distributors since November, at a price of 145,000 francs [Fr] excluding taxes," Pujos says.

When sold in tandem with the truck (which comes air-conditioned), the vehicle's total base price comes to Fr400,000.

First sales are not expected until spring 1995, as decision-making procedures of target clientele (communal governments, equipment managers) tend to be time-consuming. Noremat for its part expects about a hundred to sell in 1996.

"In the under-100 horsepower gamut, no other builder offers equipment as flexible as ours," Pujos and Bachmann agree. Iveco, a competitor in the Fiat group, has abandoned the market niche of 4X4s weighing close to 6 tons. RVI offers two models, one smaller and one larger, but neither has 4-wheel-drive transmission. The mower, mounted on the truck-bed with quick fasteners, takes only 10 minutes to remove. Boasting dual hydraulic circuits, 22 connectors, several power take-off shafts on the engine and transmission, and a reputation as a "tough" piece of equipment, Unimog also comes with options for a full panoply of work machinery, snow removal unit, and lifting equipment.

Asked about possible expansion of ties with Mercedes, Jacques Bachmann says he is happy with current arrangements. "We couldn't afford it," he jokes. Noremat has been growing steadily for the last 10 years. No industrial investment was needed to develop the joint product with Mercedes, since fabrication of equipment parts was subcontracted. Acceptance of its product by German technicians is a major step forward in the life of the company. And an excellent calling-card for a company that has worked its way up from scratch.

[box, p 28]

### Partners Described

Noremat, with annual turnover of Fr43 million and 45 employees at Ludres (Meurthe-et-Moselle), builds and maintains mowers and ground-clearing equipment for agriculture and government (maintenance).

Mercedes Industrial Vehicles has 85 agencies in France, 34 of which sell the Unimog line. As of 1993, 5,420 of its 5-ton or heavier vehicles, including 33 Unimog, were registered in France. The industrial vehicles division had 1993 sales of Fr3.6 billion, amounting to 45 percent of Mercedes Benz France's turnover for the year.[end box]

[box, p 28]



**Promoting Unimog**

Mercedes' Gaggenau plant (Bade-Wurtemberg), which manufactures the Unimog utility vehicle in addition to axles for heavy weights and parts for transmission systems, has cut back sharply on personnel since 1991. Over 3 years the number of employees there has dropped from 10,000 to 8,200. Unimog, which has been on the market since 1952, has been hardest hit by the recession: Production is off 15 percent, with no more than 3,000 vehicles expected to be built in 1994. According to company officials, the mid-range

of Mercedes' truck line suffers from the product's longevity, since the trucks are so sturdy they can be operated for 20-30 years before needing to be replaced...

Nevertheless, between now and 1997 Mercedes hopes to increase production to about 4,500 units, the minimum needed to assure Unimog's profitability.

In part this is to be achieved by increasing the attractiveness of the line, with new equipment that can lure new users.[end box]

**EU: Telecommunications, Networking Industry Strategies Analyzed**

95WS0090A Paris LE MONDE INFORMATIQUE  
in French 18 Nov 94 pp 40, 41

[Article by Pierre Mangin: "Pitched Battle Between Europe and United States"]

[FBIS Translated Text] *A strong growth potential characterizes the telecommunications and networking sector, despite the steadily rising threat posed by American competition.*

How can European industrialists continue meeting the challenge of American industrialists? In heavy telecommunications equipment, the battle has not yet begun to affect the Europeans. In the computer networking niche, on the other hand, the Europeans are being threatened if not already outperformed by the American companies. At first glance, this classing of the principal players in the French market seems reassuring. Hard on the heels of the national operating entity [France Telecom], with its [annual revenue of] 115 billion francs [Fr] (not including its subsidiaries, such as Transpac), is the Alcatel Alsthom group, followed closely by respectable manufacturers such as Matra Communications, Sagem, SAT [Telecommunications Corporation], TRT [Radiotelephone and Telephone Communications] Philips, DAT [Dassault Automation and Telecommunications]. But none of them has emerged unhurt by the crisis stemming from the stagnation, indeed the slump, in their sales in France. The telecommunications and networking sector's growth potential remains strong, but in niches from which these European giants are too far removed.

It is interesting to note, for example, the 17th place occupied by 3Com France and by Cisco and Synoptics France (Fr150 million, to which Wellfleet's Fr50 million will be added as a result of their merger in Bay Networks). In France, their revenue is modest, of course. But their annual growth ranges between +15 and +50 percent! In contrast, some very few French industrialists, such as OST and Atlantis Experdata (TRT), are managing to stay in the running, but with slower growth rates. OST is scoring points as a result of its shift toward network interconnection products. In 1993, it was number one in switchers and X.25/Frame Relay PADs [Packet Assembler/Disassemblers], with 26 percent of a market estimated at Fr660 million by IDC France. This sector is now losing momentum.

Alcatel did not await the crisis to reorient its strategies. Alcatel Business Systems restructured its PABX product lines and introduced equipment geared to future high-speed networks. But its investments are of a long-term nature and, tightly anchored as they are in the telephony universe, they are quite distanced from the local network interconnection market, which is currently the most profitable.

**PME Takeovers**

The European industrialists are not sitting on their hands. They are restructuring, acquiring innovative

PME's [Small and Medium-Sized Businesses]. The Philips group's TRT has acquired Experdata, SAT has acquired Atlantis, and CS Telecoms has absorbed RCE, etc... The case of Pouyet is significant. Having taken control of Acome, a cable and wiring manufacturer, Pouyet is leaning much more toward export than toward the national market. "These national manufacturers," says Ivan Makharine, of IDC France, "are reorienting their strategies toward the interconnection and routers market. They are launching into purely LAN products, and/or repositioning themselves as integrators." What, then, are their chances against the American leaders? A pitched battle awaits the European manufacturers. Their problem also involves distribution. They are belatedly knocking on the doors of integrators/distributors who are already monopolized by American trademarks.

[Boxes 1 through 10, pp 40, 41]:

**Networking Specialists**

**1. France Telecom**

Activity: Telecommunications carrier.  
1993 Revenue in France (Fr billion): 114.3.  
Net Profit (Fr billion): 4.8.  
Employees: 154,548.  
President: Marcel Roulet.

Distribution of Revenue: Telephone, telematics, facsimile services, 84.4 percent; private leased channels and customized networks, 7.1 percent; mobile services, 2.4 percent; information services, 2.4 percent; other, 3.7 percent.

1993/1994 Highlights: Rapid development of mobile services: Bi-Bop, Itineris, Mobipac; development of Numeris; strategic alliances with Deutsche Telekom and Sprint.

Strong Points: Fourth ranking carrier worldwide; acquisition of stake in Globalstar; launching of Transrel/ATM service; development on international scale (in Europe).

Weak Points: Financial debt totaling Fr100 billion; relative structural top-heaviness in the face of forthcoming competition (around 1998).

**2. Alcatel CIT**

Activity: Manufacturer of telecommunications equipment for big-account carriers.  
1993 Revenue in France (Fr billion): 7.88.  
Net Profit: Not reported.  
Employees: Not reported.  
Chief Executive Officer: Pierre Guichet.

Distribution of Revenue: Public switching, 53 percent; cable transmission, 20 percent; network services, 11 percent; components and vacuum technologies, 10 percent; foreign subsidiaries, 6 percent.

**1993/1994 Highlights:** Launching of the first ATM products (1000 AX product line and high-definition video coders/decoders); first penetration of ATM offering in United States (Pacific Bell).

**Strong Points:** Export success (Asia); broadband and ATM investment capability; opening of principal standard protocols to the international X.25, Frame Relay, ATM.

**Weak Points:** Effects of industrial restructuring combined with the contraction of European domestic markets; structural gigantism.

### 3. Alcatel Business Systems

**Activity:** Manufacturer of transmission systems (voice, data, images).

**1993 Revenue in France (Fr billion):** 6.6.

**Net profit:** Not reported.

**Employees:** 9,089.

**Chief Executive Officer:** Hughes Garin.

**Distribution of Revenue:** Not reported.

**1993/1994 Highlights:** Announcement of Orchestra migration strategy and of evolution of PABX systems (voice, data, images) and provision for high data transmission speeds (ATM); launching of 4400 line of business switchers.

**Strong Points:** Reorientation toward profitable niches: network interconnection systems and ATM PABX's; good export growth.

**Weak Points:** Adversely affected by domestic PABX market slump; undergoing the effects of an-depth restructuring, with change in area of operations.

### 4. Matra Communications

**Activity:** Manufacturer of telecommunications and business network equipment.

**1993 Revenue in France (Fr billion):** 5.0

**Net Profit:** Not reported.

**Employees:** 6,180.

**Chief Executive Officer:** Frederic D'Allest.

**1993/1994 Highlights:** Alliance with Northern Telecom, which has acquired a capital stake in the Matra group and forming of a jointly owned company Nortel; launching of the first GSM portable.

**Strong Points:** Strong position in government contracting (Gendarmerie and National Police); sustained GSM growth on international scale; good growth in stagnant PABX market.

**Weak Points:** Ageing of 6500 product line; difficulty in linking Matracom and Northern Telecom PABX distribution circuits.

### 5. Sagem

**Activity:** Manufacturer of communication systems (public and private sectors).

**1993 Revenue in France (Fr billion):** 4.068.

**Net Profit:** Not reported.

**Employees:** 5,750.

**Chief Executive Officer:** Pierre Faurre.

**1993/1994 Highlights:** Large-scale investments in mobile communications (GSM, 3RD); launching of the first radio terminal for electronic payment.

**Strong Points:** European leader in facsimile machines; technological know-how in radio communication; strong moorings in the public (Administration, etc...) and banking sectors.

**Weak Points:** Distribution network weakness; product line too geared to French market; structural overweight.

### 6. Alcatel Business Networks

**Activity:** Manufacturer of business communication systems.

**1993 Revenue in France (Fr billion):** 4.0.

**Net Profit:** Not reported.

**Employees:** 4,700.

**Chief Executive Officer:** Frederic Pinot.

**1993/1994 Highlights:** Creation of this new entity, pursuant to the grouping of the Opus, Alcatel, and Telic distribution networks and Alcatel's regional GST companies.

**Strong Points:** New generation of business switchers; integration of data processing (data transmission) in their product line.

**Weak Points:** Reorganization problems stemming from the merging of the above entities; continued lack of dynamism in the marketing of the new offering to business firms.

### 7. SAT

**Activity:** Manufacturer of networking and telecommunications equipment.

**1993 Revenue in France (Fr billion):** 3.064.

**Net Profit (Fr million):** 2.9.

**Employees:** 4,100.

**Chief Executive Officer:** Pierre Faurre.

**1993/1994 Highlights:** Creation of Errtelcom, a subsidiary owned 50 percent by Ericsson and 50 percent by SAT, which takes over all of the PABX's bearing the trademark of the venture; acquisition of Dr Neuhaus, specializing in telecommunications network access products; acquisition of Atlantis, a manufacturer of X.25 solutions.

**Strong Points:** Investment in radio communication and wireless network technologies; and growth capability in VFast videoconferencing modems.

**Weak Points:** Loss of market share in the PABX niche; ageing of its telecommunications product line.



#### 8. TRT (Philips Group)

Activity: Manufacturer of telecommunications and data transmission equipment.  
1993 Revenue in France (Fr billion): 1.53.  
Net Profit (Fr million): 6.0.  
Employees: 2,375.  
President: Francois Lerailliez

1993/1994 Highlights: Experdata became a 100-percent subsidiary on 1 September 1994; company entered the realm of ATM with Node 10000.

Strong Points: Complete offering as LAN and WAN designer/manufacturer/integrator; now the Philips group's telecommunications and networking flagship.

Weak Points: Belated shift toward interconnection equipment.

#### 9. SFR [French Radio Telephone Company]

Activity: Radio communications carrier and supplier of equipment and services.  
1993 Revenue in France (Fr billion): 1.35.  
Net Profit: Not reported.  
Employees: 350.  
Chief Executive Officer: Philippe Glotin.

1993/1994 Highlights: Obtained its license as GSM radiotelephone carrier; formed alliances with Great Britain's Vodaphone group and, through the Cofira holding company, with Southwestern Bell.

Strong Points: International dimension and investment capabilities.

Weak Points: Labored installation of GSM network; modesty of investments until advent of new partners; belated initiatives to redynamize its marketing policy.

#### 10. Dassault Automation and Telecommunications

Activity: Manufacturer of integration systems, communication systems, and electronic equipment.  
1993 Revenue in France (Fr million): 903.  
Net Profit: Not reported.  
Employees: 659.  
Chief Executive Officer: Boris Fostoff.

1993/1994 Highlights: Takeover of Metavideotex; absorption of electronic card manufacturer Erulec; capital increase.

Strong Points: Complete control of equipment manufacturing chain; strong position in the banking, plastic money, and transport sectors; extensive diversification in profitable niches (radiocommunications, mobile communications, ISDN, etc.)

Weak Points: Exposure to domestic market recession; weakness in commercial policy from standpoint of capturing general-user markets.

#### France: Aerospatiale's Restructuring, Modernization Reviewed

95WS0107C Paris LE MONDE INFORMATIQUE  
in French 25 Nov 94 p 11

[Article by Thierry Parisot: "Aerospatiale Intends To Hold to Its Present Course"]

[FBIS Translated Text] Strengthened by the success of its program of simplification of its information processing systems, which led to a cost reduction of 10 percent between 1992 and 1993, Aerospatiale intends to forge ahead along the same trajectory. This ratio will be sustained for 1994. In 1995, there will be differences in approach, but the objective will continue to be further cost reductions. After having eliminated some of its centralized systems including several Bull machines, in favor of MVS [Multiple Virtual Storage] and UNIX systems, Aerospatiale has turned its attention to the defining of new actions to be taken. This has led to the defining of four orientations.

The first of these, embarked upon a few weeks ago, stemmed from Aerospatiale's CEO Louis Gallois's announcement of his intention to reorganize the group. Its three divisions (Planes, Missiles, and Space and Defense), and its Eurocopter subsidiary, will be remodeled as three branches of activity: Aeronautics, Space and Defense, and Helicopters. Its Missiles activity, for its part, will continue to be exercised under its present immediate management pending a possible reorganization as a subsidiary. But just how and to what extent the information system will be affected by the new organization—whose gradual implementation is scheduled to begin in November—is not yet clear. The second action to be undertaken consists of redefining the group's software and materials resupply policy. Reducing the number of suppliers will result in the lowering of purchase prices. But the new environment will not be put in place suddenly. "We shall have to advance in carefully thought-out steps," says Guy Vauzeilles, Aerospatiale's head of computerization and investments. "I am convinced of our need of a client-server system, but the transition to that architecture must be undertaken at just the right time. The right things must also be done in terms of platforms and AGL [Automated Group Learning]." The third orientation aims at reducing the cost of subcontracting, here again through a reduction of the number of partners. Since September, the Missiles Division has been conducting a pilot information-management operation in connection with the running of the Chatillon center's pool of microcomputers. Its 4-year, 25-million-franc [Fr] contract with Cap Sesa, the only one of the four initial suppliers of services that has been retained, covers 1,600 of the Missile Division's 2,300 work positions. It aims at reducing the overall cost price of each microcomputer, heretofore evaluated at Fr30,000 annually over a period of three years, and encompasses several services: technical support, operation and renewal of the pool, control of interventions,

and a user-training plan. At year's end, the complete implementation of the contract will enable an initial evaluation.

The fourth action consists of automating the operation of the centers, with electronic document-management tools and system administration computer programs.

Lastly, by reducing its systems, with the number of work positions stabilized at 25,000 units, but with more and more PC's and workstations, Aerospatiale is "migrating toward an architecture that will enable support of the client-server," Guy Vauzeilles points out. And at the same time, overall, it is diminishing the number of information processing points.

#### **France: Reaction to Official Sanctioning of Bull's Privatization**

95WS0107B Paris LE MONDE INFORMATIQUE  
in French 25 Nov 94 p 5

[Article by Philippe Guichardaz: "Privatization of Bull: Waltz of the Suitors"]

[FBIS Translated Text] *The government has given the green light to the privatization of Bull. And already the suitors are playing musical chairs. They include on-site Bull shareholders like NEC [Nippon Electric Corporation], but also newcomers, like Motorola and AT&T, with vast ambitions.*

The notification announcing a call for bids for the transfer of a part of Bull's capital stock by mutual agreement was published in the Official Journal of 20 November. It does not specify whether this privatization will be total or partial. The sole constraint placed upon the applicants is that they be "interested in a share greater than 10 percent." This renders it possible, a priori, for a single shareholder, even though a foreigner, to take control of the company.

This issue pits Bercy, who favors total privatization, against the Industry Ministry and Bull, who would prefer a partial privatization, at least initially, with several shareholders each owning around 10 percent of the capital.

All the candidates must obtain a set of the terms and conditions and submit, by 9 December, their statement of intent to acquire stakes. This statement must stipulate the industrial strategy contemplated for each of the sectors of the Bull group. However, the sale of Bull by sections is not explicitly excluded.

#### **Candidates With Fuzzy Intent**

An initial selection will be made by the Privatization Commission operating under the Ministry of Economy. The candidates thus selected will then have six weeks in which to examine Bull's situation in depth and submit an "irrevocable" bid. At this stage, each bid may group several candidates, or one candidate associated with partners not desiring to acquire more than 10 percent of the company's capital. Bercy has undertaken to designate the selected bids within 60 days from the date of submission.

At the present point in time, only Japan's NEC, historic partner of Bull in mainframes, has clearly stated its intent to increase its current stake, probably to around 10 percent. The Japanese giant deems the attraction of the French and European market, in which Bull is well positioned, and Bull's microcomputer subsidiary Zenith Data Systems with its American base, to be well worth a "little" gesture.

IBM, for its part, allied with Bull for the past two years, has always regarded the government contract markets with covetous eyes. But IBM hardly appreciated the signing of the recent agreement, negotiated almost behind its back, between Bull and Motorola on Unix, a sector in which IBM was already collaborating with Bull. In any case, Big Blue, which has other financial priorities, has not yet stated its position.

Among the newcomers, Motorola, with its impressive financial health, could well couple its industrial agreement with Bull with a capital acquisition agreement. The last of the known candidates, the AT&T-Quadrai tandem, who would form a joint company owned 51 percent by Quadrai, would be interested in acquiring 40 percent of Bull. While the presence of the American giant, with its \$396 billion in annual revenue, renders the offer credible, other elements cast a shadow of doubt as to the outcome of the operation.

These elements include, in particular: AT&T Corp.'s divergences with AT&T Europe as to the advisability of such an operation, the absence of an industrial plan, the expressed intent to penetrate the French and European telecommunications equipment and services market, and the threat thus perceived by France Telecom—which has bailed Bull to the extent of 6 billion francs [Fr] over the past few years—and by Alcatel. It is being murmured that AT&T put this offer together solely to have it rejected and then to avail itself of that rejection vis-a-vis the American authorities in its effort to derail the agreement between France Telecom-Deutsche Telekom and Sprint.

Be that as it may, the candidate or candidates will have to bail out Bull very soon. According to several reports submitted to the government, Bull will have to post a 1994 deficit of Fr2.6 billion of its own funds, over and above the last instalment of its recapitalization, bringing its total debt to Fr10.7 billion. And its gross margin will have shrunk from Fr8.8 billion in 1993 to Fr1.1 billion in 1994. All of the group's activities, except for its mainframe and associated services sectors, which are only barely profitable, will post deficits. But above all, the lack of an intermediate-term strategy bodes ill for the future.

#### **France: Bull's Future After Privatization Assessed**

95WS0122A Paris L'USINE NOUVELLE in French  
8 Dec 94 pp 16-18

[Article by Frank Barnu and Odile Esposito: "Bull, After Privatization, Dismantlement?"—first paragraph is L'USINE NOUVELLE introduction]

[FBIS Translated Text] Privatization is beginning to take shape. The group is going to have to decide either for dismemberment via sale in parts—a prospect that has already attracted a lot of interest—or for a systems integration strategy, as the generalists would have it.

Microcomputing? Too small to dominate the world market. Unix systems? Too small; too many losses. Mainframes? Activity is declining. Systems integration? That's no metier for a computer maker (a fact that bothers many SSIs [computer systems and services companies]). There's no shortage of strongly held views on exactly what Bull group should do, with privatization now entering the stage of implementation: time is almost up for would-be investors to file their applications.

A privatization headed for success. The 11-billion-franc [Fr] recapitalization has been accepted by Brussels, on the express condition that it be the last the state provides. From now on, private investors must take the ball and run with it!

#### Dismantlement

By now nearly all analysts have concluded the group is not viable. So the privatization of this "national champion" will inevitably lead to its break-up. In other words, this chronic invalid of the computer industry that has swallowed up billions in subsidies—more than Fr20 billion since 1983!—cannot, in its present form, find anyone to buy it. The best that can be hoped is to find a few predators who, once in place, will divide the parts among themselves.

To Japan's NEC [Nippon Electric Corporation]—a declared candidate and current shareholder in the group—will go the mainframes. Bull's product line complements its own and, what's more important, NEC stands to inherit some 300 big European accounts from the French builder. To AT&T, another contender—in partnership with Quadral, the holding company for CSEE [Electronic Enterprises and Signals Company], which is headed by Yazid Sabeg—will go the Bull network and the promise of carving out more territory as a telecommunications operator. To Motorola, which almost everyone expects will declare its candidacy, the Unix business. And so on...

There are good deals to be made in Bull's liquidation sale: enough products, installed computers, technologies, and distribution networks to satisfy more than one computer manufacturer. Especially since, as some observers are urging, a literal dismemberment might be avoided by creating a cluster of "Baby Bulls," each with its own shareholders, under the umbrella of a holding company.

By adding Bull's business activity to that of each of its [new] shareholders, selling the group in segments—on whatever basis—would turn an unprofitable whole into a cluster of profitable parts. It's magic! The idea enjoys even more appeal just now, because no longer would there be a need to recarve it to distribute the parts: One of the first steps taken by CEO Jean-Marie Descarpentries was to reorganize the enterprise into seven operational divisions each with its own distinct, well-defined metier (see descriptions below).

The idea certainly has one thing going for it: It would finally resolve the Bull case, which has plagued policy makers, and drained taxpayer pockets, for years if not decades. Killing the patient is the most radical way to eradicate the disease.

That said, neither the Finance Ministry nor Bull's management admits to harboring such intentions. The former tends to favor a comprehensive buy-out. The latter, more realistic, would like to assemble "a group of industrial partners capable of helping the enterprise grow in each of its areas of endeavor." At all events, both swear by all the gods that dismantlement is out of the question and that in the long run privatization equals viability.

Are these statements so much eyewash? Pious wishes? Is there a reasonable prospect of finding one or several manufacturers committed to long-term investment in the enterprise as presently structured? Bull's history—a tale of losses, subsidies, and unkept promises—scarcely inspires optimism. But its present circumstances reflect at least some improvement. Jean-Marie Descarpentries, the savior of the Carnaud packaging enterprise before its merger with Metalbox, has acted vigorously to remedy some of the group's most glaring problems.

Beyond the reorganization itself, he has instituted a reporting method that finally gives a clear picture of profit and loss centers. He has pruned the group, eliminating nonstrategic activities such as maintenance and integration of US systems, which have been turned over to Wang. More importantly, he has taken a step that many in Bull have long awaited by breaking the "baronies" and finally creating a group management structure appropriate to the challenges at hand. All these steps, added to the effects of the personnel downsizing program initiated by his predecessor, have resulted in an operational surplus for 1994—between Fr100-300 million, it has been announced—and projections for a return to net profits in 1995.

#### IBM, DEC, SNI

But the most fundamental issue—the one on which the future of the group hinges—is perhaps something quite different. Even if the reforms undertaken by Jean-Marie Descarpentries, combined with an attractively low entry cost, make the prospective bride presentable, does it make sense today to gamble on a full-gamut computer maker at a time when most of them are losing money?

The solution to this problem, not unique to Bull, is far from clear. And it is being pondered and debated by every full-gamut computer maker. While it is too early to say whether it's the right choice, all the answers so far point toward them keeping their multiple metiers.

Take the example of IBM. The possibility of dismembering it has been discussed ever since it started on its long decline. And the company's new CEO, Lou Gerstner, took almost a whole year to decide. But he opted for the status quo. "Our clients don't want to see IBM chopped into pieces" is in essence his justification for the decision.



A second example is Digital Equipment [DEC]. Confronted with staggering losses (more than \$5 billion since 1991), the onetime leader in minicomputers has pulled out of many areas, including production of hard disks and databases. It has gone through a brutal downsizing (some 35,000 employees taken off the rolls in a 4-year period) and jettisoned its commercial force (except for large accounts) in favor of distribution. But CEO Bob Palmer says there won't be further dismantlement, though the individual divisions are destined for increasing independence. Above all, he says, there is no way it will pull out of the systems integration business.

Finally, there is Siemens Nixdorf Information Systems [SNI]. It too has had heavy losses (more than \$1 billion over the last four years). The new head of SNI, Gerhard Schulmeyer, the former CEO of ABB [Asen Brown Boveri] Inc. who restructured Combustion Engineering after its purchase by ABB, has "wired up" the German giant the way Jean-Marie Descarpentries has wired up Bull. In particular, he has drawn a bead on the manufacturer's rigidity and excessive bureaucratization. But while he claims he's prepared to dump unprofitable avenues of endeavor, he has not—so far, at least—proposed breaking up SNI.

Like Digital—which is plunging for the nth time into microcomputing, this time with its own product line—Siemens too is back in the PC market with a new line of offerings. Thus the question being asked is whether after all it is so unreasonable, as many maintain, for Bull to persevere in the microcomputer domain at a time when Zenith Data Systems, in alliance with Packard Bell, is on the verge of reaching critical mass, and profitability.

But when all is said and done, the stubbornness of these "generalists," their refusal to concede defeat, is disturbing. Is it the obstinacy of "dinosaurs" refusing to look reality in the face? How can it be justified?

#### Integration Trump

The argument being advanced rests on the contention that "the whole is more than the sum of the parts." While Compaq, Hewlett Packard, Sun and its ilk are making a fortune in specialization, full-line builders can still pull their chestnuts out of the fire by providing value-added for their clients: integration of the puzzle pieces that comprise distributed computing. "Success is no longer to be found in building components or machines," says Chuck White, senior consultant with the Gartner Group. "A more specialized manufacturer can always build something better. The way to succeed is by integrating the given set of physical platforms and available software."

Distributed computing and its open systems leave the user free to piece together the architecture he chooses from "bricks" picked up here and there. But this freedom comes at a price. In the real world, assembling those elements is still an exceedingly complex task, for the bricks don't just fit together automatically.

Getting big systems, Unix systems, networks, and "middleware" to work effectively together, "generalists" pride

themselves on their ability to tailor each piece of the puzzle to integrate into the ensemble. Thus it is to their advantage to push their pawns into the service sector, as integrators of heterogeneous systems.

Hence Descarpentries' credo: "Bull must excel worldwide in big systems, Unix systems, and microcomputers." With that proviso, any form of partnership is possible in principle. Thus, with privatization even expansion into new areas is conceivable. The "emerging technologies" division, and most of all maintenance—already turned over to Wang, in the United States—could rapidly become major income earners.

From a demand perspective, the argument makes sense. Systems integration and installation of client-server architectures are thorns in the side of most companies. In this optic—and also to guarantee the future usability of equipment already installed—many of the group's clients say they "don't see Bull's break-up as desirable." So there is at least one centripetal force, in opposition to all the voices clamoring for dissolution.

Will it be enough? One thing is sure: The transformation will entail more pain and suffering. The heart of the problem is still the move from a world of juicy profits (60 to 70 percent in mainframes) to one of shrinking margins (these days no more than about 50 percent on big Unix servers, less than 30 percent on work stations, under 20 percent on PCs, and a few percentage points on services).

The gamble on which the generalists—beginning with Bull—are staking their futures is far from being won. In the case of the French firm, we will know by 9 December, the last date for filing of applications, how many enterprises are ready to fill in for the state.

[box, pp 16-17]

#### Group Divisions Described

1. Business Servers (large and medium-size DPS 7000 and DPS 9000 systems: turnover Fr7.6 billion, 27 percent of group total; very profitable; 3,200 employees, including 1,300 in manufacturing; strong points: CMOS [compatible metal oxide semiconductor] technology, installed equipment; weaknesses: mainframe market is declining, current partnership: NEC; interested group: NEC.

2. Open Systems and Software (Unix systems): turnover Fr2.2 billion, 8 percent of group total; heavy losses; 2,200 employees, including 300 in manufacturing; strong points: ISM [Integrated Systems Management] (network supervision); Escala (premier PowerPC multiprocessor server); rapidly expanding market; weaknesses: insufficient market share; current partnerships: IBM, Motorola, Harris, Tandem, 3 Com, etc.; interested groups: Motorola, IBM, etc.

3. Microcomputing (Zenith Data Systems): turnover Fr6 billion, 21.5 percent of group total; breaking even; 1,800 employees, including those in manufacturing; strong points: partnership with Packard Bell (grouped purchases and mass-market microcomputers), multiprocessor



servers; weaknesses: critical mass not yet attained; current partnerships: Packard Bell (Zenith owns a 19.9 percent stake); interested groups: all microcomputer makers.

4. Systems and Services Integration: turnover Fr2.9 billion, 10 percent of group total; losing money; 2,800 employees; strong points: renowned for expertise and methods; weaknesses: competition from SSIs, difficulty of simultaneously being judge and competitor; interested groups: all the SSIs.

5. Client Services (maintenance): turnover Fr8.1 billion, 28.5 percent of group total; profitable; 7,000 employees; strong points: profitable activity (installed equipment); weaknesses: revenue from installed mainframes declining, rise of multibuilder maintenance; interested group: activity in the United States sold to Wang.

6. Facilities Management (Athesa): turnover Fr280 million, 1 percent of total; losing money; 618 employees; strong points: soaring market; weaknesses: capital-intensive start-up; current partnership: Cisi (50-50 partners with Bull in Athesa, Inc.); interested groups: all the facilities management specialists.

7. Emerging Technologies (chip cards, electronic cards, automatic tellers, point of sale [POS] terminals); turnover Fr1.1 billion, 4 percent of group total; profitable; 900 employees; strong points: Bull CP8 technology in chip cards, crypto-card for network security; weaknesses: non-strategic activities; current partnerships: Siemens (crypto-card), TRT (electronic "purses"); interested groups: all firms specializing in chip cards, banking terminals, etc.[end box]

### Siemens Nixdorf France's Business Performance, Prospects Evaluated

#### CEO Interviewed

95WS0115A Paris LE MONDE INFORMATIQUE  
in French 25 Nov 94 p 40

[Interview with Siemens Nixdorf France CEO Jacques Reboul: "France Will Become Profitable Again in 1995"; by Philippe Guichardaz; place and date of interview not given]

[FBIS Translated Text] After three years of restructuring, Siemens Nixdorf's French subsidiary is beginning to reap the fruits of its efforts, says the company's CEO Jacques Reboul, even though its net operating result remained in the red in 1994. Growth factors: PC's and UNIX exclusively through indirect sales.

[Guichardaz] What balance will you be posting for the 1993-1994 operating year?

[Reboul] It is a transition year after three years of restructuring, but one whose outlook is a return to profitability in 1995. We have reduced our losses from 477 million francs [Fr] in 1993 to Fr333 million this year, including restructuring outlays, and we expect to post a Fr8 million profit in 1995.

Restructuring costs and especially social plans, which helped reduce to 12 the number of actual severances resulting from the elimination of 412 jobs in two years, will no longer be a burden on the 1994-1995 balance sheet.

[Guichardaz] Siemens Nixdorf France had already announced a return to profitability in 1994. Now, your sales have dropped. Is your goal for 1995 realistic?

[Reboul] France is a separate case in the Siemens Nixdorf group, in that the group sustained four entities in France: Leanord, subsequently taken over by IN2, Siemens Data, and Nixdorf. This greatly complicated our restructuring operations. As for revenue, the part corresponding to sales in France rose 8.7 percent to Fr1.482 billion; sales by our parent company dropped by half to Fr201 million, owing in particular to lessened market demand. Global revenue suffered a slight drop of 5 percent to Fr1.683 billion. I am confident, therefore, with regard to our objective for the current operating year. The restructuring is behind us and our revenue can be expected to verge on Fr2 billion.

[Guichardaz] On which sectors are you basing this projected growth?

[Reboul] As regards equipment sales, which totaled Fr820 million in 1994, up 23 percent, we are banking mainly on microcomputers and UNIX machines. This year, we sold 34,000 PC's and we are projecting a total of 52,000 units in 1995. This will rank us seventh on the French market. Our objective is to rank fifth within three years.

[Guichardaz] What are your strong cards in the PC market?

[Reboul] We entirely renewed our line in September. In addition, we have a plant at Hauboudin, Leanord's former microcomputer production center. This puts us close to our clients, and is a particularly important point under our contract with France Telecom, to whom we have provided 14,000 PC's in two years.

As regards prices, we systematically align our products on the market leader, namely Compaq. And since 1 October, our distribution system operates exclusively via indirect sales, except in the case of a few perfectly well known big accounts.

[Guichardaz] With what types of distributors are you going to work?

[Reboul] We shall be signing an agreement with a major distribution chain before the end of the year. A similar operation will take place during the first quarter of 1995. From the multispecialist viewpoint, the group is present in the FNAC and at Boulanger. Other marks of merit will be added shortly. Everything is aimed at cost reduction. This strategy, coupled with better utilization of our industrial potential, enables us to make money in France in the PC sector.

[Guichardaz] As regards cost reduction, does the Siemens Nixdorf group have enough industrial clout, so to speak, to enable it, for example, to procure components at lower prices?

[Reboul] The recent operation effected with Escom fits precisely into that logic. Our acquisition of a 10-percent stake in its capital is coupled with an industrial agreement under which we will manufacture cards for its PC's. Between us, we will be representing a million units, which amounts to real purchasing power.

[Guichardaz] With respect to UNIX, what are your positions and your ambitions?

[Reboul] With 10 percent of the French market for UNIX servers, we are in fifth place. In 1995, we expect our UNIX sales to rise from Fr105 million to Fr130 million. We have a complete line of machines and will shortly be announcing multiprocessor solutions. And, as in the case of PC's, the group owns a world-class industrial site in France. As for the distribution, it will also be by the indirect route via the OEM [original equipment manufacturer] and VAR [value-added reseller]. Unlike the PC distribution system, however, we handle the big accounts directly.

[Guichardaz] Do you not encounter the same difficulties as do the other manufacturers with respect to UNIX, namely, operation of the proprietary pool?

[Reboul] No. We do not have that problem in France, inasmuch as, for historical reasons (Unidata), the installed base of Siemens mainframes (BS2000) is very small. With very few systems therefore having to migrate, we have no difficulty whatever in offering UNIX.

[Guichardaz] What is your strategy as regards services, where you appear to be less aggressive than the other major manufacturers?

[Reboul] Our position is very clear. We have no intent to become an integrator and to compete with the service companies. We specialize in system architectures. As regards application and systems integration, I prefer to work through partners, and, if necessary, to be the subcontractor of an integrator. This partnership can be perpetuated, as for example in the case of our agreement with SAP, or remain on a case-by-case basis. This message has been clearly conveyed to the service companies, and they prefer to work with Siemens Nixdorf rather than with manufacturers who have become their direct competitors.

[Guichardaz] And as regards consultation?

[Reboul] In France, we work with several major consulting firms. In Germany, we have an in-house structure called SIETEC.

[Guichardaz] Do you really prefer to stay out of the services market, considering that it is synonymous with growth and comfortable margins?

[Reboul] No, because Siemens has a strong tradition of services to the client. We are therefore present in the field, via the maintenance of equipment, which represents a revenue of Fr600 million.

[Guichardaz] But is proprietary maintenance not slowly grinding to a halt?

[Reboul] That is true. We have undergone a 5-percent decline in that activity. Of our 8,000 clients in France, 6,000 have quite high maintenance costs with machines they inherited from the different companies that now comprise the groups (Picks and Quattro pools, for example). But as we gradually replace those machines with UNIX architectures, maintenance costs drop for our clients as well as for us. It is thus a drop in activity that is nevertheless highly profitable.

[Guichardaz] Are you contemplating a shift toward non-proprietary maintenance? With what means?

[Reboul] Yes, because we have attained critical size, both human and geographic, with respect to maintenance. We are currently in a phase of acquisition of companies operating in that market, be they entities specializing in niche products, or in specific markets such as banking terminals, or in third-party maintenance.

In the future, our maintenance activity will consist of three branches: a "proprietary maintenance" branch; a "maintenance of equipment other than Siemens Nixdorf" branch, an activity that represented a revenue of Fr80 million this year; and a branch that will include notably cabling and wiring, and local area networks. This configuration of activities could represent a total revenue of Fr2 billion within five years.

[Guichardaz] Siemens Nixdorf's image has suffered some difficulties with which you have had to cope during recent years. How do you propose to remedy this situation?

[Reboul] We are capitalizing on the Siemens name, which is synonymous with quality and perpetuity, and on our European identity, which positions us as an alternative to Bull in France. Moreover, if a French firm that has chosen our products decides to set up in Germany, it is assured of finding the same equipment there. This is an important point given the trend toward globalization of computer system purchases.

And lastly, we are going to increase our communications budget, which to date has been turned inwardly because of the restructuring, and redeploy it into advertising campaigns.

#### Balance Sheet Presented

95W50115B Paris LE MONDE INFORMATIQUE  
in French 25 Nov 94 p 6

[Article by Philippe Rose: "SNI France Reduces Its Losses"]

[FBIS Translated Text] On its way out of last year's 425-million-franc [Fr] hole, more than half of which was owing to restructuring charges, Siemens Nixdorf [SNI] France reduced its losses in 1994. The manufacturer is still in the red, however. Its operating result is negative in the amount of Fr173 million, and its net loss totals Fr333 million, taking restructuring costs into account. Its revenue this year, Fr1.68 billion, is down 9.5 percent. SNI France's CEO, Jacques Reboul, is projecting a return to

operating equilibrium in 1995, with revenue markedly up 17.5 percent and a positive balance of Fr8 million. To attain this objective, SNI is counting on a strengthening of its partnerships in the direction of PME's [Small and Medium-Sized Businesses], PMI's [Small and Medium-Sized Industries], and SSII's [Computer Services and Engineering Companies], and on the upgrading of its product lines. Its microcomputer lines have been completely renewed, with its Scenics and PCD's, 35 new models of which were announced on 1 September. SNI sold 32,000 PC's in France in 1994, versus only 18,000 in 1993.

[Graph accompanying the source text is titled "SNI France: Equilibrium In 1995?" and portrays the following information]: SNI France's revenue rose from Fr1.704 billion in 1992 to Fr1.859 billion in 1993, then dropped to Fr1.683 in 1994. Projections call for an increase to Fr1.977 billion in 1995. Net operating results were -Fr113 million for 1992, -Fr200 million for 1993, and -Fr173 million for 1994. A profit of +Fr8 million is being projected for 1995. Its staff numbered 1,985 employees in 1992, 1,760 in 1993, and 1,500 in 1994. Projected 1995 strength is 1,470 employees.

#### **Germany: New Research Institutes to be Founded in New Laender**

95WS0106C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE ZEITUNG  
in German 6 Dec 94 p 8

[Article by d.p.a.: "MPG to Establish 20 New Institutes. Research Cutbacks in the Old Laender"]

[FBIS Translated Text] By the turn of the millennium, up to 20 Max Planck Institutes are to have been established in the new German Laender, primarily for basic research in the natural sciences. So far nine new Institutes have been founded in Eastern Germany, according to the president of the Max Planck Society (MPG) Hans Zacher. The Society currently has more than 67 Institutes in Germany as well as more than 27 limited working groups and seven centers for the humanities in Eastern Germany.

In fiscal year 1993, the Max Planck Society had 10,026 established posts and 862 employees paid for with money from project funding. The annual budget was roughly 1.6 billion German marks [DM], DM154 million of which went for activities in the new Laender.

The limited financial scope makes it necessary to relinquish a number of research facilities in the old Laender. Zacher said. The Society calculates that in the coming years only three out of four vacated professorships will be filled. Research work abandoned because of emeritus retirements would not be carried on.

In 1994 the Society founded four institutes in Eastern Germany. These are the Marx Planck Institute for Molecular Plant Physiology, which is to be located in Golm near Potsdam; the Max Planck Institute for the History of Science in Berlin; the Max Planck Institute for Neuropsychological Research in Leipzig; and the Max Planck Institute for Gravitational Physics, also to be located in Golm.

#### **German-U.S. Cooperation in Developing Materials Protection Reported**

95WS0106A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE ZEITUNG  
in German 6 Dec 94 p 8

[Article by n.r.b.: "Doped Polyaniline Used as Rust Protection"]

[FBIS Translated Text] A thin layer of polyaniline has been shown to be an effective protection against rust in experiments by the American space agency NASA and the Hamburg firm of Zipperling Kessler. Doped with hydrochloric acid, the semiconductor polymer can be used as a protective coating for the space shuttle launch ramps. Zipperling Kessler has in this context also developed a process by which the protective coating can be applied. The product could already be on the market within the next six months.

At NASA, using this rust protection would save more than \$250,000 a year. Up to now the steel construction of the launch structures at Cape Canaveral have been given a zinc plastic protective [coating]. Because of the aggressive gasses released at the launch of a space shuttle, iron corrodes very quickly. The nearly hector-sized surface area must therefore be repainted for every launch, which is very time-consuming, requiring two working days to do.

The new protective coating was tested on soft steel at the Los Alamos National Lab. The [test] piece lay in dilute hydrochloric acid for more than 25 weeks without rusting. Uncoated test pieces showed indications of corrosion already after four weeks. Tests at Zipperling Kessler indicate that the new protective coating also rusts less quickly than does a piece of steel coated with zinc.

The German company findings are that via the semiconductor material a thin layer of iron oxide forms which passivates the iron oxide [directly] underneath, according to a report in the journal NEW SCIENTIST (1994, No. 1949, p. 24). NASA, on the other hand, believes in the direct protective effect of the doped polymer. Since the hydrochloric acid doping material is resupplied at every shuttle launch, the protective film should only need to be renewed every three to four years.

While the work at NASA is still in the research stages, Zipperling Kessler has, according to statements, already made the polyaniline available as a coating.

#### **Netherlands: Philips, Thomson, SAGEM Partnership's Expansion Plans**

95WS0104A Paris LE MONDE in French 10 Dec 94  
p 20

[Article by Alain Franco: "In Partnership With Thomson, SAGEM, and Merck, Philips Aiming at 8 Percent of Liquid Crystal Screens Market"]

[FBIS Translated Text] The outlook for development of AMLCD's [Active-Matrix Liquid Crystal Display(s)] is enough to make the electronics giants' heads spin. Since



November 1992, Philips (Netherlands), Thomson (France), SAGEM [Company for General Applications of Electricity and Engineering] (France), and Merck (Germany), a producer of liquid crystals who recently joined the group, have been allied in a jointly-owned company called Flat Panel Display (FPD). On Wednesday, 7 December, at Eindhoven, they announced an expansion of production at the Eindhoven site, and the study of a proposed new installation.

Eindhoven—The creation of FPD was not painless. Philips was hard put to enroll other industrialists in the venture of the flat screens with multimedia applications (LE MONDE of 30 November 1992). But market studies, and especially the realization of the strategic and economic importance of a sector that was bound to grow significantly, finally overcame the reluctances. Today, Philips owns 70 percent of this joint enterprise, and Thomson, SAGEM, and Merck own equal shares of the remaining 30 percent. The total investment comes to more than 1.5 billion francs [Fr].

Prior to the company's entry into the production of AMLCD's, the field was a Japanese monopoly, with Sharp its uncontested leader. Today, FPD produces 40,000 standard 10-inch screens a month, and expansion of the plant will enable it to increase this output to 75,000 units a month. "By the year 2000," says Chris Stuve, president of the company, "we will have 8 percent of the market, putting us in fifth or sixth place among the world's producers."

The applications of these screens range almost to the infinite, encompassing anything to do with imaging, data processing, automobiles, aviation, electronic games, videotelephones, television, and multimedia equipment. Very soon, nothing will escape the need for these ultraflat screens crammed with electronics, in which each colored point is controlled by a transistor. Portable computers are absorbing the lion's share, or 70 percent, of the total worldwide production of AMLCD's. This year, 25 percent of the 8 million portables sold were equipped with them. Lightweight, practical, and relatively robust, 20 percent of these screens enter into the composition of miniature television sets (which among other things are extensively used in airplanes), portable compact disk players, automotive steering and information monitors, and other miniature game consoles.

Projection equipment will represent 5 percent of production output, as will video cameras. FPD, however, is staying out of the latter market. Too limited, says Chris Stuve. Large-screen projection, on the other hand, is opening new perspectives, as are also high-definition TV and electronic movies.

"One of our clients is already working on these applications. Initial tests are encouraging, even though the image definitely lacks brilliance. Within two years, the problems will be resolved," Chris Stuve promises. And one of FPD's officials adds, "Steven Spielberg already has a \$40,000 projector in his home, equipped with Philips screens, and Madonna uses our products on stage..."

#### Reject Rate

In 1993, the screens market, all systems included, totaled \$19.1 billion. Cathode ray tubes represented 71 percent of this market, and AMLCD's 12 percent. By the year 2000, according to Stanford University, the market will total \$35.6 billion, and the AMLCD share will be 24 percent. Annual sales of AMLCD's worldwide, currently totaling Fr15 billion, will rise to Fr45 billion in 1998, progressing by more than 30 percent annually until the year 2000.

The product's fantastic growth is not sufficient in itself to explain the optimism felt by FPD's management. "In all, 130 of our 650 employees work in development, while research is done by the partners in the joint venture," says Chris Stuve. "Moreover, we use the so-called TFD-R technology, which differs from that used by the Japanese manufacturers. TFD-R enables us to create brighter, hence cheaper, screens. It is also less costly. And we are relying heavily on our shareholders and their worldwide sales network." FPD's future also depends on the mastering of an error-proof technique. A speck of dust, the slightest deviation, can entail the tossing of the screen onto the scrap heap. Not very long ago, the screen reject rate was over 50 percent. Has FPD improved this rate? Its executives unanimously invoke the company's right to secrecy "so as to not tip off the competition." Its researchers are studying a derived technology developed by the French CNET [National Center for Telecommunications Studies]/SAGEM partnership. Concurrently, the study of a new production unit, undoubtedly in Asia, is progressing rapidly. "We are considering a partnership with a regional group. It could be Korean or a Singapore group, but under no circumstances a Japanese one," says Chris Stuve, dropping two hints: "Korea will be embarking on this road in 1995/1996, and our technology resembles that used in the manufacture of electronic components." FPD is not totally independent of Japanese industry, however. The high-quality glass used for its screens comes from... the Land of the Rising Sun. And so it will be until Saint-Gobain, which is currently studying the market, decides to join the battle.



**Romania: Philips Subsidiary, Romtelecom Joint Venture's Project**

95P60069A Bucharest ROMANIA LIBERA  
in Romanian 24 Dec 94 p 4

[Article by Romulus Maier: "High Technology Under 'Testing'"]

[FBIS Translated Text] According to the general director of a Philips subsidiary in Romania, Mr. Romeo G. Ball-estra, each dollar invested in telecommunications generates a three-dollar increase in the gross domestic product. These words were spoken on 21 December 1994, during an official ceremony that marked the launching of cooperation between Romtelecom and Philips. The object of this venture is installing the ring-shaped pilot system named System Digital Synchron (SDS) in Romania. SDS is a

product of Philips Communications System, a branch of the Dutch electronics concern, which contributes about 9 percent to the firm's yearly turnover. This transmission system will be tested for one year within the (Romanian) telecommunications network.

One remarkable SDS performance is its transmission of 622 Mbit/s, which corresponds to 9,600 simultaneous telephone conversations taking place through one single fiber optic cable. So far, Philips has installed one decentralized-switching-mode crossed-linked LXC 4/1 system in each telephone switching center at Drumul Taberei II, Victoria, Dacia and Vitan. Romtelecom is willing to buy the product if still satisfied by its performance after the completion of a 12-month period. Thus, let us rejoice: for one year we will be able to use the phone in "western conditions."

### Performance of French Companies in China Analyzed

95WS0094C Paris INDUSTRIES ET TECHNIQUES  
in French Oct 94 pp 76-78

[Article by Laurence Girard: "Tribulations of the French in China"; introductory paragraphs in boldface as published]

[FBIS Translated Text] The market share held by French firms in China does not exceed 2 percent. The pioneers—the PSA [Peugeot Corporation], Alcatel, Schneider, Danone, and so on—are pulling PME's [small and medium-size businesses] in their wake. When they arrive, there is a rush of candidates to form alliances.

Once established, firms expect to see a return on their investment within three years. That was the case for Merlin Gerin.

PME's have already been trying their luck on their own. Examples are the food processing firm Somdina, Gilbert Laboratories, and furniture manufacturer Seribo.

The reception room at an arms factory in Beijing has recently become a popular place where people rush to sample the tasty cuisine of the Thai minorities. That is one indication, among others, of the race for money that is gripping China. Its momentum is smashing the last taboos. State enterprises are closing their doors and laying people off. The word "unemployment" is no longer banned from the vocabulary. The enterprises, accustomed to selling their production to state stores, are being faced with consumer demand. Most see no salvation except through cooperation with a foreign company, the purpose being to obtain the latest technology, improved quality control, and competitive production facilities as quickly as possible. All of which means that every foreign firm wanting to establish itself in China will be ardently courted.

But as one travels through the streets of Beijing, the presence of French firms is not exactly obvious. In the flood of vehicles that have mercilessly dethroned the bicycle by relegating it to the shoulder of the road or even excluding it, as is practically the case in the center of Shanghai, Peugeots and Citroens are rare. The most prestigious models of the Mercedes firm mingle with Japanese cars and the Santanas manufactured locally by Volkswagen and shamelessly overtake the yellow "Made in China" vans that are used as taxis—the cheapest vehicles on the market. That desire for luxury is benefiting the Cognac shops which, having always been firmly established in the Far East, are the only notable exception to the almost complete absence of French products on the Chinese market. Big lighted billboards shaped like bottles of cognac—exclusively XO—abound.

The fact is that French firms have emphasized the sale of equipment goods for industry: electric power plants through GEC-Alsthom, diesel power plants through New Sulzer, telephone exchanges installed by Alcatel CIT, and equipment for industrial projects. In 1993, such equipment accounted for nearly 87 percent of exports valued at

9 billion francs [Fr]. Kits for vehicles assembled by Peugeot in Canton and by Citroen in Wuhan contributed 20 percent of that total amount. A similar share is accounted for by chemical and iron and steel semimanufactures. Consumer goods pale into insignificance at only 3 percent.

Some companies are not content to export: they have decided to establish themselves permanently and take the industrial gamble. It is true that the doors have been open for almost 15 years now and that foreign investment receives favorable treatment. The inflow of capital has been increasing, with the result that the sums invested quadrupled between 1990 and 1993 alone.

Of the pioneers, the Merlin Gerin firm, a subsidiary of the Schneider group, became interested in the Chinese market in 1985. At the time, choosing its partners or its location was out of the question. The Grenoble firm found itself married to two companies responsible to the Ministry of Aviation. It was a fortunate marriage of convenience, according to Michel Collonge, head of the joint venture, who hastens to add: "There are no good or bad partners; it is up to us to adjust." The very young firm was one of the first to establish itself in the Teda development zone 60 kilometers from Tianjin, Beijing's industrial suburb. Many others have followed, among them Yamaha, Kodak, Coca-Cola and, very recently, Motorola, whose tinted-glass building would not look out of place in a Western industrial zone. A tax exemption for three years followed by a 50-percent reduction in taxes: those few gifts have served as an incentive. Moreover, there is plenty of manpower in this region, which until now has been agricultural. The only shadow in the picture is that Chinese cadres have not been attracted to the new city built in the immediate vicinity of the Teda zone. The marina housing developments where one can put one's feet in the (brackish) water of the salt marshes are not considered desirable.

The automobile manufacturers, PSA in the lead, also discovered this market very early on. Established in 1985, the GPAC (Guangzhou Peugeot Automobile Company) assembles 504 and 505 model pickup trucks in Canton. Even better, taking advantage of the planning of the Chinese automobile industry, Citroen joined with one of six selected companies to establish a joint venture known as the DCAC (Dongfeng Citroen Automobile Company) in 1992. What is at stake is the building of a plant in the country's interior on the Yang Tse River—more specifically, in Wuhan—where Citroen ZX's will be mass produced under the name Fukang in 1996. Production capacity will eventually reach 150,000 vehicles.

The Alcatel firm, acting through its Belgian subsidiary Alcatel Bell, also got an early start by establishing itself 10 years ago. Result: its share of the market in terms of lines installed exceeded 56 percent in 1993.

But the very rapid growth of the Chinese environment may lead to a new deal of the cards. When Alcatel, for example, joined with the Ministry of Telecommunications, that choice might have led it to expect some degree of exclusive rights. But then two other ministries—Industry and Transportation—claimed the right to operate in the telecommunications sector as well, with the result that one joined with

Northern Telecom and the other with AT&T. Moreover, a new five-year plan—the ninth—is going to establish guidelines that will govern the automobile industry beginning in 1996. It is possible that the first companies on the scene—the current leaders Volkswagen and Citroen, followed by Chrysler, Peugeot, and Daihatsu—will be joined by others. General Motors and Ford of the United States, Mercedes of Germany, Toyota, Nissan, and Honda of Japan, and Renault of France are knocking at the door. To gain admission to the circle of the elect, the firms are submitting to the requirements. The word of command now is to increase local content in the vehicles and help local equipment manufacturers achieve an international level of competence. GM, Ford, and Toyota have taken the bait and formed partnerships with Chinese equipment manufacturers. While waiting for something better to come along, Mercedes has been content for the moment to appeal to the ordinary man and create an image for itself. Nearly 30,000 Mercedes are now on the road in China, most of them brought into the territory illegally. But the German company says it is prepared to defend its plan to produce a family car at a meeting scheduled to be held in Beijing in November for the purpose of comparing various competing projects. Its family car is actually a minicar seating three people—at a price that should be attractive enough to appeal to consumers. Because few individuals—only 50,000—own cars in their own names. Only diplomats, members of the government, executives in joint ventures who demand to find one in their package of perks, and businessmen own cars. And of the 1.3 million vehicles produced in 1993, automobiles accounted for only 250,000 units. Utility vehicles predominate. Renault has therefore chosen that means of establishing itself in the market. A year ago, it signed a joint venture agreement that will enable it to produce Traffic vehicles in the vicinity of Wuhan.

A tropism is attracting a number of French manufacturers to this city in the interior far from the coveted coastal strip, because the PSA group is pulling its equipment manufacturers and subcontractors in its wake. Alain-Claude Carree, head of Sogedac, the PSA's purchasing subsidiary, has sent out a vibrant appeal to his suppliers. He feels that the presence of 120 of them is essential. But he can cite only 30 joint venture agreements already signed and about 60 in the works.

Those agreements are often a two-stage affair. First a technology transfer contract is signed. Then a joint company is formed. The Ecia group, which will manufacture exhaust systems in partnership with the Chinese firm Tongda, chose that two-stage procedure. The granting of a license was negotiated for an initial amount of Fr2 million and payment of a 5-percent royalty on all products sold during the first 10 years. The joint venture agreement was signed this summer. The Treves company, which specializes in interior trim for vehicles, has taken only the first step. Then comes the snowball effect. In their turn, the equipment manufacturers ask their subcontractors to take an interest in the Chinese market. That is how the heads of two PME's—Gradel (in Cluses) and Garconnet (in Eu), both of which are suppliers to a number of equipment

manufacturers—came to be in the office of Michel Colonge of the Schneider group seeking information. He says: "Not a week passes without some manufacturer coming to ask me about my experience."

Other PME's, not benefiting from the dynamics of the big companies, are tackling the market on their own. Gilbert Laboratories, for example, first chose to enter the Hong Kong market commercially. Then, by getting to know the right people, it found its Chinese alter ego in Suzhou. Now they produce cosmetics together. The Seribo furniture firm, a member of the French-Chinese Committee, has opened three furniture stores in Shanghai. If it gets a good reception, it will build a local factory with its partner, the 9-9-9 company. Somdiaa has already built a few mills and a unit for the production of frozen products.

Most of the firms feel that the return on their investment will come within three years. That was the case with Merlin Gerin, which has experienced steady growth. The number of its employees has risen from 50 in 1987 to 370 today. Now it is looking for a new site. It is true that it must keep its lead at a time when Siemens has signed an agreement with an enterprise in Suzhou and when the Legrand and ABB [Asean Brown Boveri] firms are about to arrive. And expand its operations to other provinces.

The location of one's partner firm, the way in which it is perceived in the market, and its approach to marketing channels are factors to be considered when a company wishes to establish itself. As has been said, it is not likely to lack suitors, all of them avid for technology and improvements in the quality of their products. To realize this, one need only watch the broadcasts on Chinese television screens. All day long, between strings of commercials whose intensive use of computer-generated images is surprising, there are reports on model enterprises: automated machinery, high-tech enterprises, and quality certification have taken the spotlight away from meritorious workers. Being satisfied with outmoded technology is out of the question. Chinese manufacturers want to move fast. They are taking advantage of the eagerness of foreign manufacturers, whose eyes light up at the very mention of the market's potential—1.2 billion consumers—to play them against each other and negotiate the best deal for acquiring those technologies. The problems with counterfeiting must be taken into account. While they are very frequently mentioned in connection with luxury products, industrial products are not safe, either. The case of Merlin Gerin is a good illustration of this (see below). Potain cranes and spare auto parts are other examples. Laws protecting intellectual property have been promulgated. The remarks reported by LES ECHOS regarding the penalties incurred by counterfeiters give one pause: "Fines, prison sentences ranging from three to seven years, and even the death penalty for the most serious cases."

No doubt about it: China's economic power is already a reality. According to a study published by the CEPII (Center for International Prospective and Informational Studies), it is in second place, ahead of Japan. And whereas France imports over Fr20 billion worth of Chinese products, it ranks only 12th among China's suppliers, with 2

percent of the market. French firms need to head for China and ponder the Chinese proverb: "One must know how to fish with a long ribbon."

#### Boxed Material

##### Merlin Gerin Victim of Counterfeiting

The same characteristic orange strip, the same silk-screened initials, and the same shape: these circuit breakers are practically indistinguishable from those being shipped every day from Merlin Gerin's plant in Tianjin. But when they are lined up on the desk of Michel Collonge, head of that Schneider subsidiary in China, they are all just so much proof of the wave of counterfeiting that is victimizing his company.

The first copies saw the light of day in 1991. Since then, the phenomenon has spread steadily. The most fantastic figures are circulating. It is said that about 100 counterfeiters have already sold several million circuit breakers. Some of those pirates are small shops that specialize in making copies, while others are established companies well known in the field of electrical equipment. "It's the price of glory," says Collonge, who admits he is surprised to see the reference number C45 becoming a standard: "The copies help popularize our product." Optimistic talk aside, the French-Chinese joint venture known as Tianjin Merlin Gerin is trying the low-key approach in its reaction. There is no question of sending out the steamrollers to crush piles of pirated circuit breakers—"we could be accused of plagiarism ourselves"—or of filing resounding lawsuits. All the more in view of the fact that while laws recognizing industrial property were promulgated this year, the means of enforcing them have not been completely worked out. The key word is still "negotiation." Persuading certain manufacturers to put their own names on the product or change the color of the strip and getting a pirating plant shut down as an example to others—those are just so many small victories. Above all, Collonge says that Merlin Gerin's real strength resides in the quality of its products. Its goal is to keep improving that quality and to protect itself better in the future. In the case of the differentials that the company is just starting to produce, trademarks and patents have been scrupulously registered.

##### Zhang Hairong: a Chinese in Paris

How can a PME sell in China? Zhang Hairong provides an answer through her firm, the AES. Address book in hand, she guides companies through the procedures. It all began with the project for establishing Citroen in Wuhan. Small firms supplying test equipment for the automobile assembly lines took an interest in that market. It was impossible for them to send someone to China full-time to install and maintain the equipment. So the AES firm will have an organization on the spot, Chinese employees will be trained in France by the various companies concerned, and they will then provide service on the companies' behalf. The BIA firm (90 employees and a turnover of Fr70 million) has signed such a contract. The PSA's order represents a total of Fr3 million. The BIA is now asking the

AES to help it continue its canvassing by arranging interviews for it. The Ateq firm (100 employees and a turnover of Fr70 million) has been emphasizing exports for five years and derives 50 percent of its income from that business. It has been canvassing the Chinese market with the AES for the past two years. It admits that its effort is actually an investment at the moment, because the margins are smaller than in France. In all, the AES has already helped about 10 firms on their Chinese journey.

#### Joint Ventures

In Beijing, Aquitaine Plastics is selling bicycles, of all things! Selling bicycles in China—that beats all! But a small company with 30 employees—Aquitaine Plastics—is taking up the challenge. In the greatest secrecy, it is designing a bicycle of plastic and composite materials for the Chinese consumer. Those are light and more malleable materials for the designer, who favors the details of a utilitarian bicycle over those of a racing bicycle. This PME thinks it can produce such a bicycle at low cost with its partner, the Institute of Aeronautical Materials in Beijing, which it met at the European Seminar on Composite Materials.

Also in Beijing, Pernod Ricard owns 65 percent of a joint venture whose production totals 11 million bottles. Lafarge Coppee (51 percent of a joint venture) produces 1 million metric tons of cement per year. Carnaud Metalbox (60 percent of a joint venture) produces 500 million beverage cans. Danone is also in Beijing. And Saint-Gobain produces electrocast refractories.

Schneider, in Tianjin since 1987, produces circuit breakers and differentials.

In Xiaogan, Renault (45 percent of a joint venture) produces 40,000 utility vehicles (Trafic and variants).

In Chongqing, Air Liquide processes bottled gas.

In Wuhan, Citroen (25 percent of a joint venture) will begin assembling 150,000 ZX's per year in 1996.

Automobile equipment manufacturers are establishing themselves in Wuhan, where 30 agreements have already been signed and over 60 are in the works. The location there of the PSA and, just recently, Renault is encouraging equipment manufacturers to establish themselves in Wuhan. Valeo, the Ecia, Treves, and Bertrand Faure are a few examples. Others preceded them in China at the instigation of Volkswagen: Autoliv, for example, which recently joined with SAGEM [Company for General Applications of Electricity and Engineering], a firm manufacturing security equipment. The equipment manufacturers are being followed by their subcontractors, examples being Gradel and Garconnet.

In Canton, Carnaud Metalbox (85 percent of a joint venture) produces food cans, beverages, and aerosols. Air Liquide produces gas for the chemical and metallurgical industries. Peugeot (22 percent of a joint venture) assembles 505 and 504 pickups.



In Dalian, Total (20 percent of a joint venture) refines 5 million metric tons of petroleum per year.

In Cindao, Rhone-Poulenc produces 20,000 metric tons of precipitated silica per year.

In Shanghai, Alcatel Bell (32 percent of a joint venture) has two plants producing telephone exchanges. It installs 4.7 million lines per year and manufactures electronic components. Carnaud Metalbox (65 percent of a joint venture) produces food cans. Elf-Aquitaine operates a refinery. And Rhone-Poulenc (51 percent of a joint venture) produces 3,500 metric tons of polyamide per year as well as surfactants in Wuxi.

In Suzhou, Gilbert Laboratories is discovering Tiger Balm. A lucky date—28 February—was chosen for inaugurating the joint enterprise established by Gilbert Laboratories and a Chinese counterpart. The two cosmetics firms are the same size (200 employees). The traditional Tiger Balm will be joined by shampoo, antimosquito cream, and suntan lotion formulated in France using local raw materials. Although improvements remain to be made, the organization and quality of production surprised the French visitors. So did the karaoke nightclub where personnel relax in the evenings and on Sunday—Sunday being their only day off.

#### **Germany-India: Cooperation in Development of Catalysts Cited**

95WS0102B Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 30 Nov 94 p 8

[Article by G.M.: "India's Chemicals Looking for Innovative Concepts. The Country Is Looking for Cooperation with the Most Powerful Companies in the World"]

[FBIS Translated Text] Bombay—Anyone wishing to sell obsolete technologies has dialed the wrong number in India. Moreover, the chemical industry of the country is searching for innovative solutions that ensure India's competitiveness even into the future. This can only happen via international cooperation with the most powerful companies. Jasu Shah, president of the Indian Chemtech Foundation, noted this recently in Bombay.

International joint ventures have become an important stimulus and growth engine for the economy of India that is structured predominantly of medium-sized businesses. According to the observations of K.C. Damodaran, many medium-sized businessmen today have become the most important consumers of chemical systems and products. Damodaran is the deputy director of the German-Indian Chamber of Commerce. One example of this is the Reliance Ltd., a textile manufacturer rich in tradition. Within a few years, this company has risen to become a powerful petrochemical concern.

For India, Germany is the second most important trading partner after the United States as a vendor of items of capital investment for the chemical industry. The

Chemtech Triple Expo that took place from 15 to 18 November in Bombay was an international branch event. The partner country of Germany was represented at this event with its own special show. An accompanying seminar on the topic of "Clean Technologies" took place under German direction.

Among others, Hugo Lang, marketing director of Endress & Hauser, presented a series of measuring technology applications. These not only satisfied modern standards, they also became an international model. Bernhard Sojer is the responsible engineer for the area of centrifuges at Kraus Maffei. He demonstrated how, using the Clean Technology Process in the pharmaceutical area, not only could high-grade products be produced, but costs could be reduced at the same time.

Josef Sporer is the director of Linde Process Technologies India Ltd. In Bombay, he explained a process that removes sulfurous compounds from industrial gases simply. A. Banerjee is the responsible process engineer for Lurgi India Co. Private Ltd. He presented a talk on the topic of "Residual-Free Refining" that was the topic of much discussion.

A license to import process-engineering machines, devices and equipment to India is no longer needed. The customs duties have been reduced to an international level. Having a middle class and upper class of about 150 million people with good purchasing power, India represents a market of good selling potential for German chemical technology. With an annual growth rate of 15 percent, the chemical industry of India can be described as very healthy. Chemicals can assume the role of a "catalyst for the upturn" in India, says Jasu Shah.

#### **Germany-Japan: Cooperation Council for High Technology Founded**

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in German 14 Dec 94 p 8

[FBIS Translated Text] A German-Japanese Cooperation Council for High and Environmental Technology will perform specific work useful to the enterprises of both countries, rather than prepare studies that have no practical significance. With these words the German chairman, the former BMFT [Federal Ministry for Research and Technology] minister Heinz Riesenhuber, described the agreed-upon goals of the current council meeting in Tokyo. As an example, Riesenhuber cited establishing norms for future technology standards and initiation of enterprise partnerships. Personnel exchange was included as the third central field of activity in the work program. The council is made up of eight representatives each from Japanese and German industry and two scientists from each of the two countries. The cochairman is Waturo Mori, chief of the council for science and technology, subordinate to the Japanese prime minister. Besides promoting industrial cooperation, the council, according to information from the German embassy, also serves to develop future markets.

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